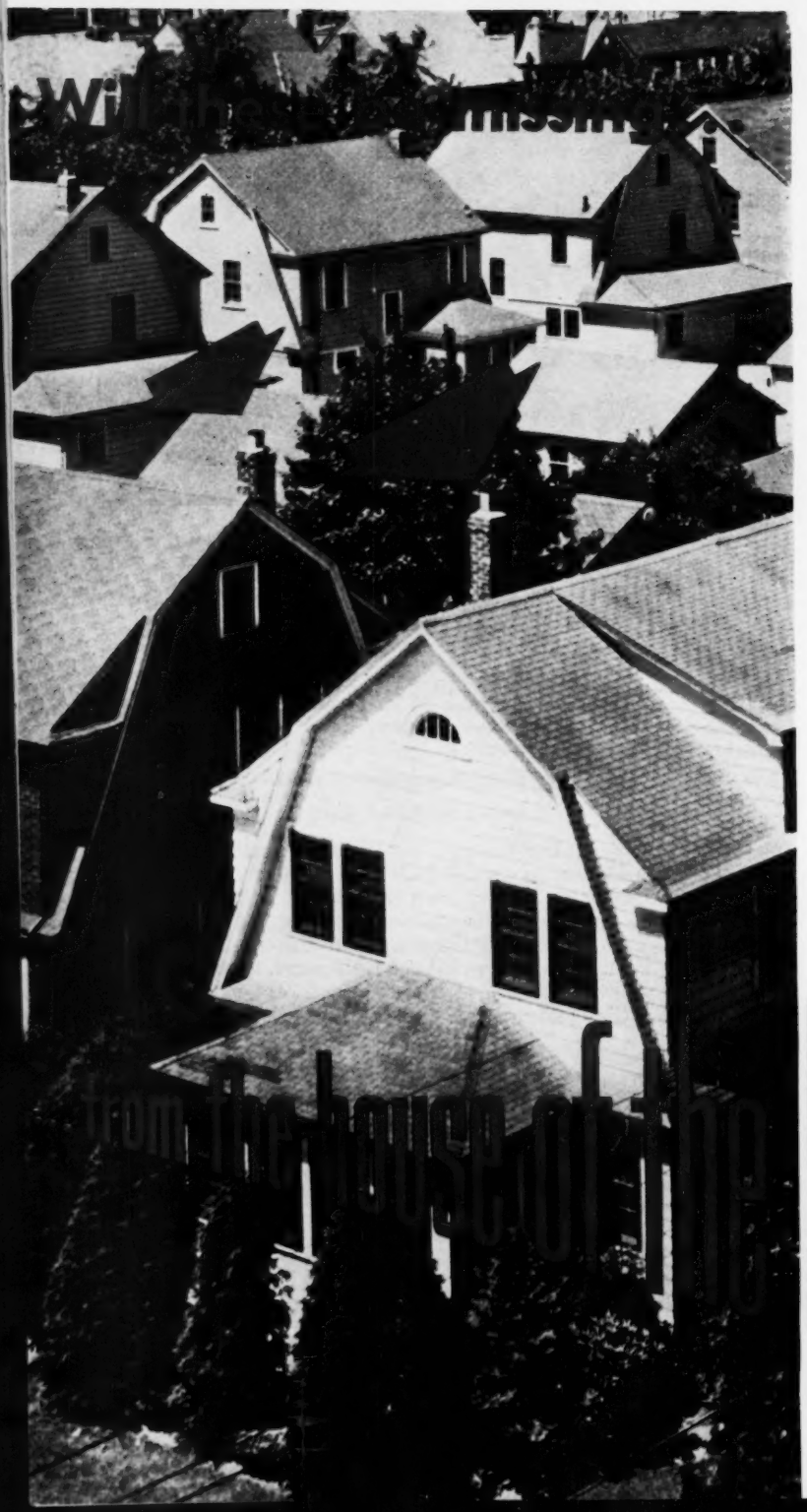
NOVEMBER 2, 1953

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

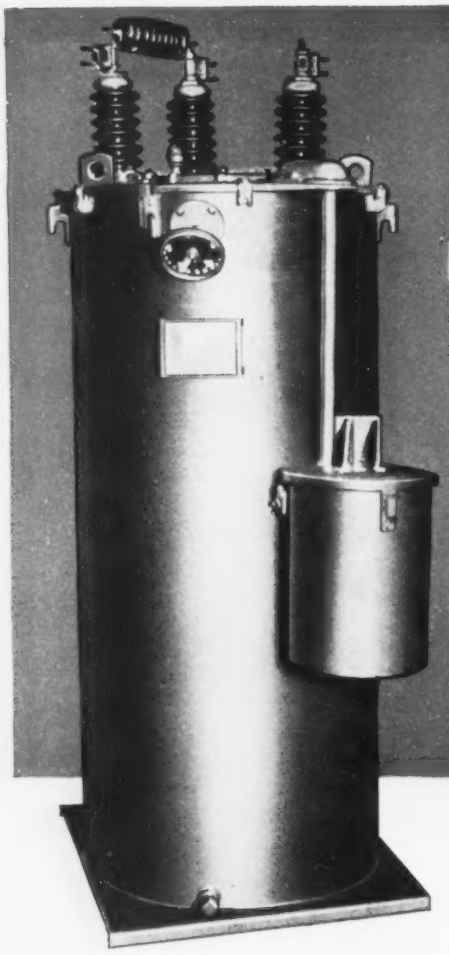


Data from Electric House Heating installations in...

Illinois
Michigan
Missouri
Nebraska
New Jersey
Ohio

See Page 80

Future?



NOW 14.4 Kv

Distribution Regulators for Entirely New Voltage Applications

ALLIS-CHALMERS 5/8% STEP VOLTAGE REGULATORS

Here's the answer to voltage regulation economy for an entirely new application: introduction of a 14.4 kv Allis-Chalmers distribution regulator means you can bring all the advantages of single-phase distribution regulation to 25 kv grounded neutral systems and 15 kv delta systems. All the famous Allis-Chalmers 5/8% step voltage regulator features have been designed into the new unit.

Design Permits Switching From 15 to 25 Kv Grounded Systems

For 25 kv grounded neutral systems the new 14.4 kv distribution regulators have the same insulation class as similarly rated distribution transformers. Best of all, reduced voltage taps make application to present 15 kv grounded systems possible — and you can use the same distribution regulator on a 25 kv grounded system when conditions require.

Reduce Equipment and Installation Costs

Significant savings in initial equipment and cost of installation can be made now that the distribution regulator is being manufactured in this new rating. It will pay to get more facts about the 14.4 kv distribution regulator. Call your nearby Allis-Chalmers district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4149

RATINGS AVAILABLE	
	14,400 Volts — 50, 100 amp
	7620 Volts — 15, 50, 100 amp
	5000 Volts — 50, 100 amp
	2500 Volts — 100, 200 amp

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Originators of 5/8% Step Regulation

House Heating Looms Up

Normally, Electrical World serves up to its readers a balanced diet, the proteins of engineering, the carbohydrates of management, and the vitamins of selling. This keeps strong and healthy the grasp of readers on the activities, problems, and developments of the industry in which they serve. But occasionally it seems to the editors that a more than usual allowance of one element in the diet would benefit readers and an issue devoted to a single theme is published.

This issue is one of that kind. In it are eight articles on electric house heating. And why such a slug of them at this time?

You'd be hard put today to find a home that is not lighted by electricity. The time will come when it will be as hard to find a home not heated by electricity.

Next year Light's Diamond Jubilee will be celebrated. It took electric lighting 75 years to reach its present estate. Electric heating will move along much faster because these are faster times and people expect great things from electricity which they did not three quarters of a century ago.

The reason then for the heavy emphasis this issue puts on electric house heating is that the sooner our industry gets squared away on the next big job of electric service the better it will be for all concerned.

That's why you find in this issue articles telling about acceptance of electric heating by rural dwellers, pointing out characteristics of the load that may have important effect on cost of serving it, comparing methods of heat loss calculation, and presenting data from load research.

House heating raises important problems for the electric utility—immediate problems of distribution, design, rate making and sales policy, and, as time goes on and the load grows larger the problem of providing generating capacity will loom. These articles are a contribution towards correct statement of the problems of house heating, without which they can not be solved.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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case history

easy to terminate

These Okolite-Okoprene 15-KV shielded cables are installed at the Great Northern Paper Company's East Millinocket Plant, Millinocket, Maine. They typify the ease with which this kind of cable is terminated. No potheads were required. The termination required far fewer manhours of labor, as contrasted with the involved and expensive operation of terminating other types of cables which require a lead sheath. This is one reason why the switch today is to Okolite-Okoprene rubber-insulated high voltage cables.

WHY THEY'RE SWITCHING TO OKOLITE
rubber-insulated cables for use up to 35,000 volts

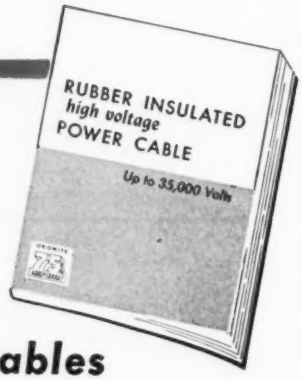
There is a distinct trend among industrials and public utilities toward Okolite rubber-insulated cables for high voltage use.

ADVANTAGES

1. Lighter and easier handling.
2. Eliminates sheath corrosion and fatigue.
3. Simplifies splicing and terminating.
4. Moisture does not affect the insulation.
5. No oil migration at high temperatures or elevations.
6. Flexibility simplifies installation.

APPLICATIONS

1. Transmission and distribution circuits.
2. Generator and transformer leads.
3. Vertical risers and shaft cables.
4. Submarine power cables.
5. Portable substation cables and test leads.
6. X-ray cables.



Send for this 128-page manual on rubber-insulated high voltage cable. It provides current carrying capacity tables, dimensional data, engineering information and installation procedures, complete instructions and detailed drawings for splices and terminations. Write for Bulletin EW-1075 on your letterhead to The Okonite Company, Passaic, New Jersey.

OKONITE SINCE 1878 *insulated cables*

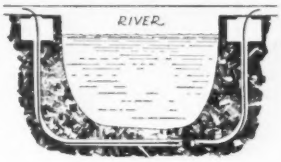
1861

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!

Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.



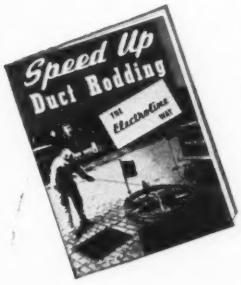
EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

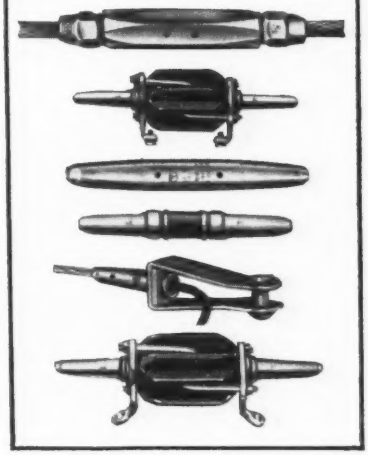
- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.



OTHER *Electroline* PRODUCTS



Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO

IN RELIABILITY OF PERFORMANCE

S&C POWER FUSES

DRIVE SPRING AND PULLEY

CO_2 GAS BOMB

for quick interruption of low current faults

UPPER STRESS CONE

withstands high recovery voltage

ARC EXTINGUISHER CHAMBER

where the arc is drawn and extinguished

BORIC ACID LINING

in arc extinguishing chamber. Packed under 6,000 pounds pressure

FUSIBLE ELEMENT

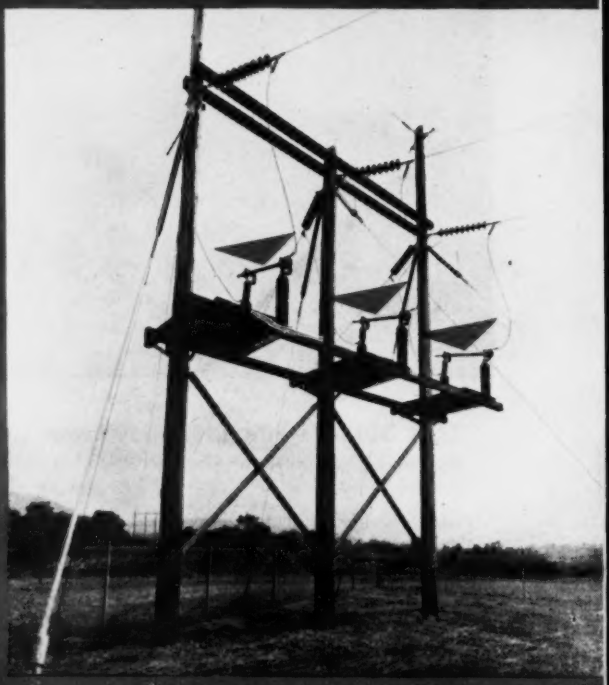
made of silver, helically coiled, retains its time-current characteristics permanently because it cannot be damaged by vibration, age, lightning, or other current surges

CORONA SHIELD

protects fusible elements from corona damage

LOWER STRESS CONE

withstands high recovery voltage and confines arc core within fuse tube



Three horizontal 115 KV S&C Power Fuses, Type SMD-2, installed at a sectionalizing point.

Three 69 KV S&C Power Fuses, Type SMD-2, protecting transformer primaries.

S&C

SPECIALISTS IN HIGH-VOLTAGE

are Fully Equal to the Best-Engineered Circuit-Interrupting Devices of ANY Type

SPECIFICALLY, THIS MEANS THE ABILITY TO...

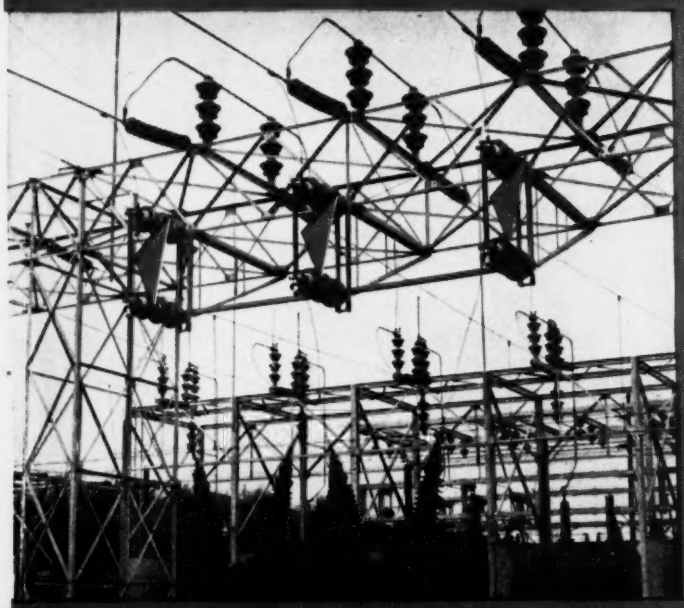
- interrupt every fault current—low as well as high
- "Ride out" harmless, momentary surges that eventually may cause "sneak-outs"
- Give indestructible time-current characteristics since element construction is not vulnerable to aging, severely corrosive atmospheres, vibration, surges, or corona
- Clear the circuit of any fault with precision without prolonged arcing or flashovers that lead to phase-to-phase faults or other consequences

Forty years of intensive engineering and research have developed S&C Power Fuses to a point where today they are as completely reliable as the most advanced circuit-interrupting device, regardless of type.

To achieve this success, S&C engineers threw out all previous notions about current-responsive techniques and circuit interruption, and started fresh.

Entirely new concepts were evolved and refined, until today the reliability of S&C Power Fuses is so well established that the leading electric utilities trust them completely to protect valuable installations and maintain dependable service. They are using S&C Power Fuses with outstanding success where fuses never have been used before.

Probably S&C Power Fuses are the answer to your protection problems. Why not write for full information, today?



Write for Catalog Section 262

which gives a complete description of SMD-2 Power Fuses, including applications and ratings.

ELECTRIC COMPANY

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CIRCUIT INTERRUPTION

BITUMINOUS COALS FOR EVERY PURPOSE

Whatever your fuel needs, we have a coal that is

Just the Ticket!

• In fact, you can write *your own* ticket—for the vast Bituminous fields served by the Baltimore & Ohio contain excellent coals *in wide variety*. For centuries to come, these coals will be available—a dependable source of low-cost heat and energy.

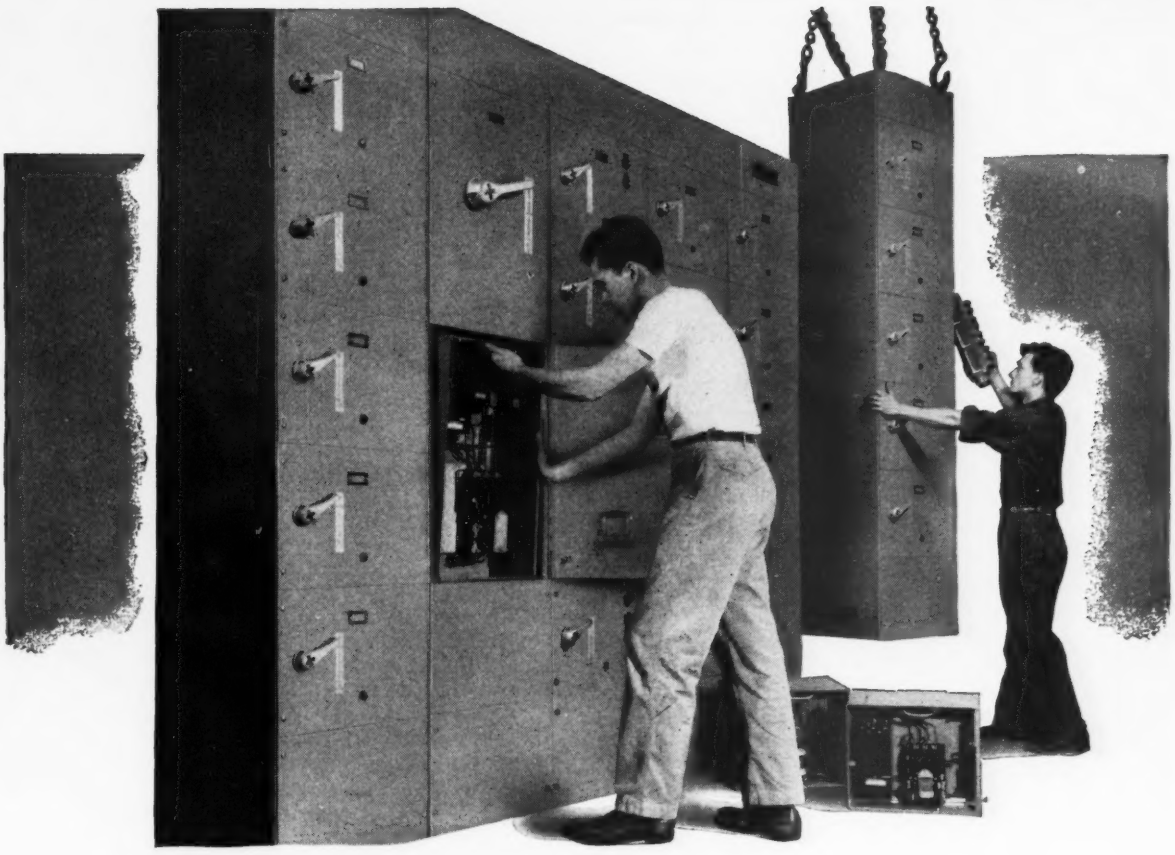
Modern mechanization at the mines assures low costs as well as uniform size and quality. The location of the fields—close to industry's front door—contributes to low transportation expense. Storage is economical because costly facilities are not required. And with the help of new combustion methods and equipment, Bituminous offers its users an increased burning potential.

ASK OUR MAN! He can give you worthwhile advice as to supply sources and burning methods for the particular coal you need. The efficiency, economy, and cleanliness of B&O Bituminous today will be a revelation!

LINKING 13 GREAT STATES WITH THE NATION

BALTIMORE & OHIO RAILROAD

Constantly *doing things* —better!



FLEXIBILITY

of electrical components...of structural units

Another reason why most control center buyers specify WESTINGHOUSE

No matter what type and size of motor control you need, you can house it in a Westinghouse Control Center. That's not so unusual in itself. But, the important thing is the ease with which these control units are initially installed and then interchanged as circuit requirements change.

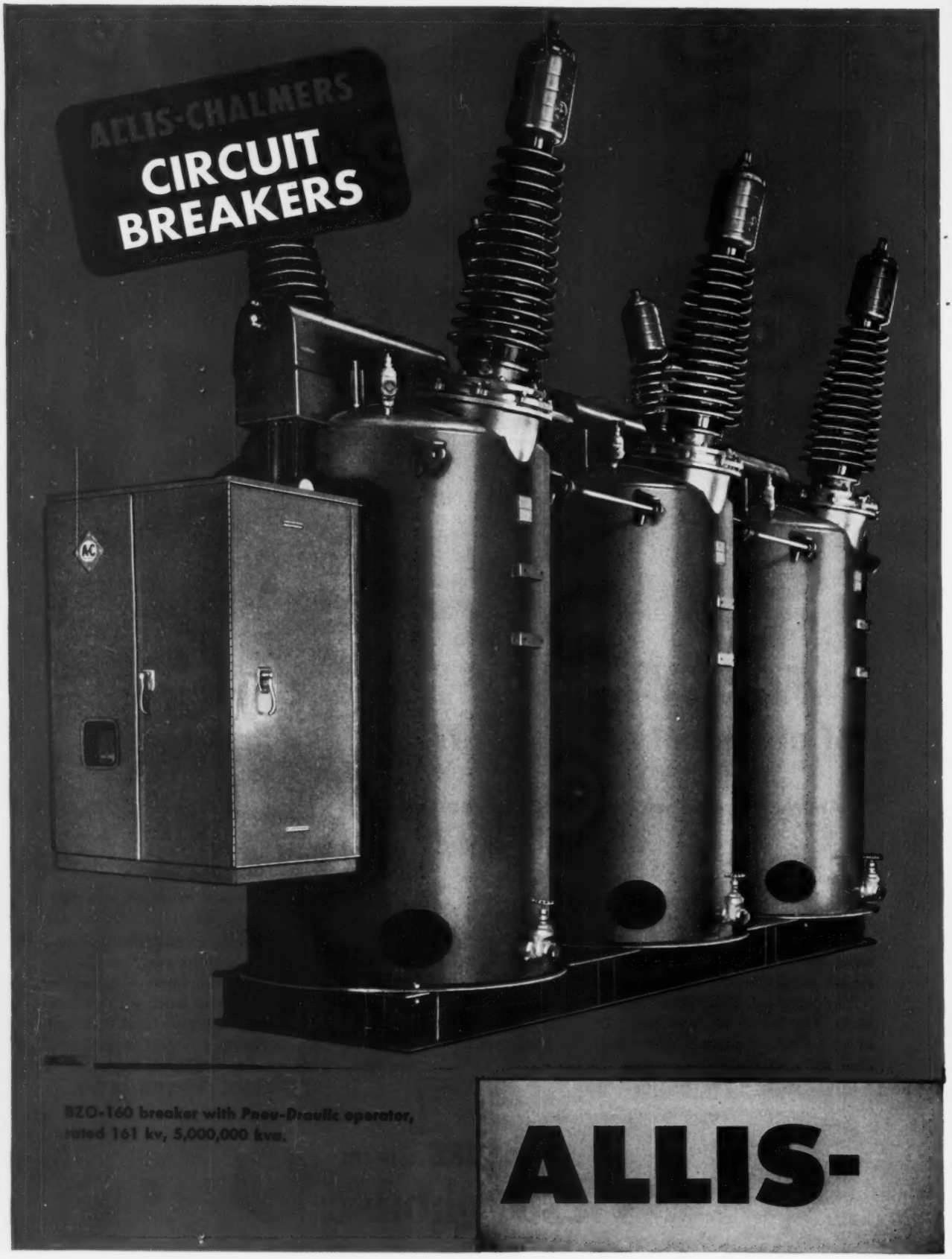
The secret is in the standardization of cubicle dimensions. The height of these units are 14″ or multiples of 14″. Thus, all units are completely interchangeable. One 28″ unit can replace two 14″ units—three 14″ units can replace one 42″ unit—etc.

Standardization of vertical structures also aids flexibility. You can arrange, rearrange, add or subtract vertical structures to meet any requirement. Each structure dovetails perfectly with its neighbors.

Need help? Westinghouse offers you the services of an application engineer to work with you on your control center planning. Call your local Westinghouse office today. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-27023-A

YOU CAN BE SURE...IF IT'S

Westinghouse


ALLIS-CHALMERS
CIRCUIT BREAKERS
BZO-160 breaker with Pneu-Draulic operator, rated 161 kv, 5,000,000 kva.
ALLIS-

All Breakers Completely Assembled

PRIOR TO SHIPMENT

Installation of Allis-Chalmers Breakers is FAST...EASY

Every detail gets thorough going-over in factory. For example: every breaker is completely assembled and test operated. Parts are marked for alignment — numbered — tagged — for easy, fast field assembly.

Breaker quickly installed — no guesswork — no delays!

Reliability is another feature! Allis-Chalmers breakers in all sizes, all types of operators are full mechanically trip-free. Breaker trips instantly at *full speed* even when operator is closing.

To get these important features on your breakers — specify Allis-Chalmers.

For complete breaker story, call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

The Secret of FAST Contact Alignment

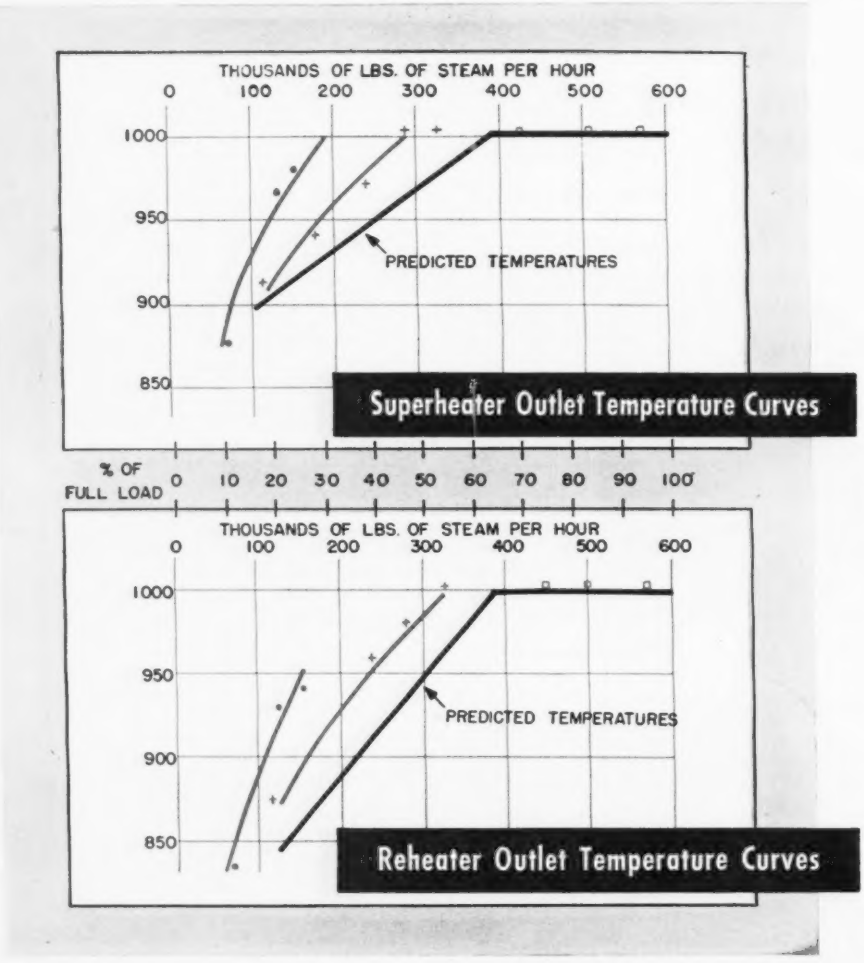
Adaptor ring eliminates time loss in alignment. Adaptor rings and bushings are factory aligned and marked for ease of installation during field assembly. Adaptor rings are left in position during shipment. Field assembly time is greatly reduced. Bushing seat gaskets are properly weather sealed by tightly secured bushing flange bolts.

A-4152

Pneu-Draulic is an Allis-Chalmers trademark.

CHALMERS A-C ALLIS-CHALMERS

RILEY Reheat Unit at Maintains Constant Reheat *down to less*



Plus

Over-all performance better than guaranteed with air heater exit temperatures and draft losses lower than predicted.

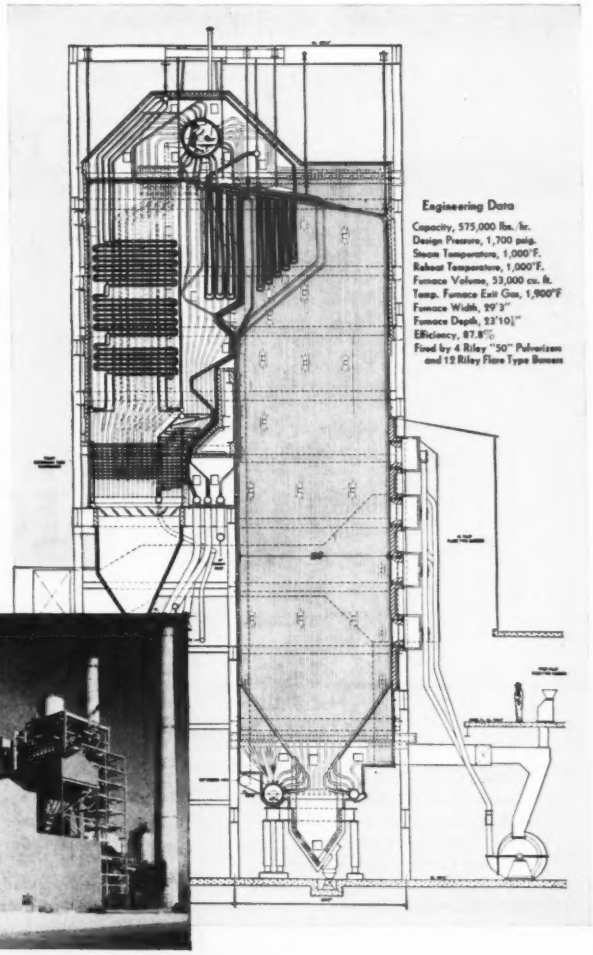
A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power cost

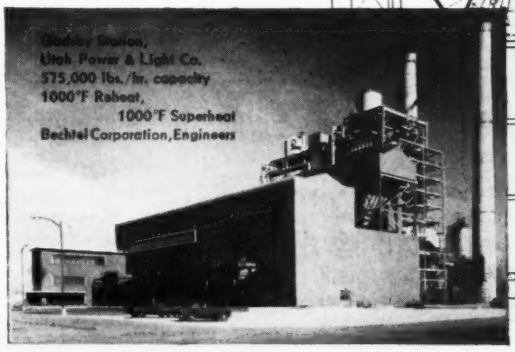
Utah Power and Light Company and Superheat Temperatures *than 50% load!*

The modern Riley Reheat steam generating unit at the Gadsby Station, Utah Power and Light Company, has continued to give entirely satisfactory service without a single major alteration or adjustment since it went on the line in November 1952.

The unit is designed for a nominal turbine flow of 575,000 pounds of steam per hour and uniform total reheat and superheat temperatures of 1000°F each, with loads down to 400,000 lbs./hr. To accomplish this, primary elements of the reheater are exposed to the furnace and absorb heat by radiation. The practicability of this design has been borne out in performance with *constant temperatures down to less than half load.*

In addition, over-all performance was better than guaranteed with air heater exit temperatures and draft losses lower than predicted. Here is another good example of the advantages to be gained from doing business with Riley. Time after time Riley units have produced performance bonuses such as this. You, too, can possibly realize large savings in power costs by installing Riley steam generating units.


Engineering Data
Capacity, 575,000 lbs. /hr.
Design Pressure, 1,700 psig.
Steam Temperature, 1,000°F.
Reheat Temperature, 1,000°F.
Furnace Volume, 53,000 cu. ft.
Temp. Furnace Exit Gas, 1,900°F
Furnace Width, 29'2"
Furnace Depth, 23'10½"
Efficiency, 87.8%
Fired by 4 Riley "50" Pulverizers and 12 Riley Flare Type Burners



These Public Utilities Have Ordered Riley Reheat Units

Houston Lighting & Power Co.
1,250,000 lbs. hr. 1005°F Reheat

Texas Electric Service Co.
1,250,000 lbs. hr. 1005°F Reheat

Public Service Co. of Indiana, Inc.
984,000 lbs. hr. 1005°F Reheat

Dept. of Water & Power
City of Los Angeles
1,200,000 lbs./hr. 1000°F Reheat

Louisiana Power & Light Company
1,000,000 lbs./hr. 1005°F Reheat

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STOKER CORPORATION

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BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS
WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

You get a full 12 inches

but only 7 inches

for the same

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Hunzicker Brothers
Interstate Electric Co. of Shreveport, Inc.
Maydwell & Hartzell, Inc.
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Nelson Electric Supply Company
Price Electric Company
Russell Beldon Electric Company
S. M. Supply Co., Inc.
Southern Minnesota Supply Company
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Stubbs Electric Company
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Line Material Company
General Electric Supply Company
Westinghouse Electric Supply Co.

Solid and Stranded Neoprene and Polyethylene Covered Conductor • Self-supporting Triplex Cable • ACSR • All Aluminum Conductor

# of aluminum

12 INCHES

# of copper

7 INCHES

amount of money!

THE PRICE of 7 inches of #6 copper weatherproof wire is about $.02705.

But you get 12 inches of #4 Kaiser Aluminum polyethylene weatherproof wire for that much money—a full five inches more!

This extra five inches means big savings.

1000 feet of copper costs you $46.27. 1000 feet of Kaiser Aluminum costs you only $27.05. That's a saving of $19.22 per 1000 feet!*

Any type of Kaiser Aluminum weatherproof wire will give you *substantial* savings over copper of equivalent current-carrying capacity.

And it's a fact that Kaiser Aluminum can save you *additional* money in handling, construction and maintenance. Our Field, Engineering and Laboratory services have an unmatched reputation for helping customers do a better job at lower cost.

It's another reason why Kaiser Aluminum has become the nation's largest producer of weatherproof and insulated aluminum wire and cable.

Give us a call, or drop us a line. We'll be glad to give you the full story. Or contact one of our many distributors, listed on the opposite page. Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.

*Based on August, 1953 prices for #6 Copper TBWP and #4 Solid Aluminum, Polyethylene or Neoprene covered.

Kaiser Aluminum

Setting the pace—in growth, quality and service

NOW
Great New Line of
FWD Trucks with
MATH-O-MATIC DESIGN
A significant engineering achievement which puts
the power where there's work to be done by
properly proportioning weight and torque

FWD MATH-MATIC DESIGN *for*

Greater Economy—30 to 37% more tire wear!*

Greater Performance—40 to 82% more tractive ability!*

*Greater Safety**

Now, it's top truck performance at minimum operating cost, thanks to exclusive FWD Math-Matic Design, the most important advancement in 43 years of heavy-duty truck leadership.

Now, it's an all new line of FWD "Fourmaster" and "Sixmaster" series trucks with the widest range of G.V.W.'s in the industry . . . plus 15 other big features to give you more service for your truck dollar.

FUNCTION-ALL STYLING for easy mounting of snow-plows, underbody blades, dump bodies and other equipment. Choice of crown or military-type fenders.

RIGI-TAPERED FRAME—25% stronger. Heat-treated alloy steel. Deep taper design *rigidizes* front end for mounting plows and other equipment, distributes load over entire frame. Above-frame area unobstructed for easy mounting of bodies and equipment.

REAR AXLE—30% stronger. Full-floating. Diameter increased from 1.812 to 2.000.

POWER PROPORTIONING CENTER DIFFERENTIAL—Not only power on *all* wheels, but properly proportioned power for maximum performance at minimum operating cost.

EASY-ACCESS HOOD—Removable side panels and "butterfly" hinged top sections permit instant access to engine, despite close-mounted auxiliary equipment. Radiator filler cap conveniently located *outside* hood.

TRUNION-MOUNTED RADIATOR—Floating construction, isolated from frame by rubber. Takes the tough shocks without cracking core, shell or hood.

VALVE-IN-HEAD ENGINES in all trucks—light weight, high power output. Diesel engines available for all models.

CUSHIONED ENGINE MOUNTINGS—FOURMASTER and SIXMASTER series engines are three-point rubber mounted; quieter, vibration-free.

12-VOLT ELECTRIC SYSTEM—Quick power-surge for cold weather starting; hotter spark, less loss of current under heavy lighting loads.

HEVI-DUTY STEERING GEAR and linkage assures positive control under roughest operating conditions. Lessens road shock and vibration, makes steering a cinch. Power steering optional on all models.

COMFORT CAB—Lots of leg room. Picture-window visibility. Cab hood is three-point rubber mounted. Adjustable seat, of light, strong tubular frame construction. Tip-out instrument panel for easy access. Minimum floor openings for greater protection from fumes and cold. I.C.C approved outside-mounted fuel tank.

STIRRUP-ACTION CLUTCH & BRAKES—Power assisted brakes, hydraulically assisted clutch. Suspended design of both pedals for easier servicing . . . provides "stirrup" action for greater leverage, regardless of driver's height.

POWER OPERATED CENTER DIFFERENTIAL LOCK—FWD Center Differential Lock manually controlled but power-actuated. Red dashboard light warns when lock is on.

LONGER FRONT SPRINGS insure easier riding, improved steering geometry. Ox Bow tied in with spring mounting brackets for greater frame strength.

FULL-BRUNT BUMPERS—25% stronger Lighter, tougher heat-treated alloy steel.

**TRUCK RESEARCH PROJECT conclusions. For detailed data on 7 years' research conducted by the University of Wisconsin's College of Engineering, write now for your free copy of "The Truck That Went to College"*

THE FOUR WHEEL DRIVE AUTO CO.

CLINTONVILLE, WISCONSIN • Canadian Factory KITCHENER, ONTARIO

NOW... See your FWD dealer. He knows!*

FWD®

MATH-MATIC DESIGN

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

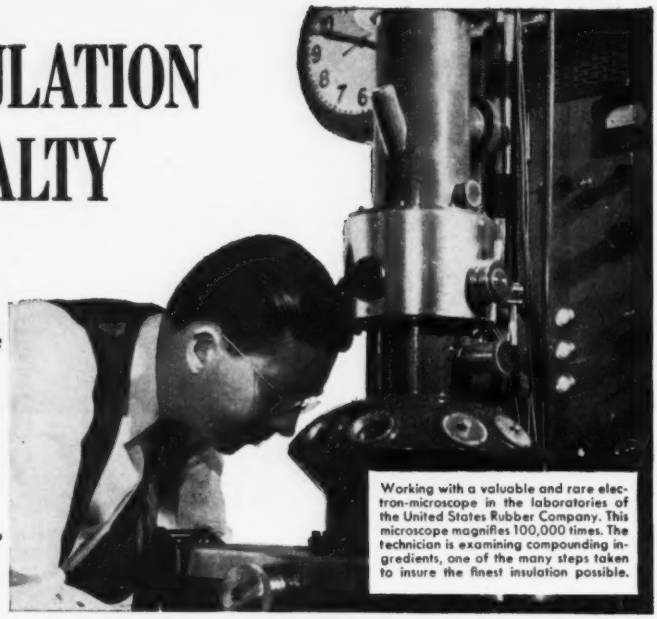
A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.



Working with a valuable and rare electron-microscope in the laboratories of the United States Rubber Company. This microscope magnifies 100,000 times. The technician is examining compounding ingredients, one of the many steps taken to insure the finest insulation possible.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables • Street Lighting • Royal Cords • Network Cables • Utility Control • Pole & Bracket Cable • Service Entrance • Weatherproof • Zip Cord Pole Fixture Cable • Sup. Control

RAILROADS: Power Cables • Communications • Railway Signal • Royal Cords • Welding Cable • Railway Utility • Sup. Control • Weatherproof

HEAVY INDUSTRY: Power Cable • Royal Cords • Welding Cables • Control Cables • Machine Tool Wire • Building Wire • Switchboard Wire • Thermostat Cable • Bus Drop Cable

ONE OF MANY SUPERIOR "U. S." WIRE AND CABLE PRODUCTS

USKORONA-NEOPRENE POWER CABLES

Ozone-resistant for high-voltage applications in wet or dry locations.

These cables are for use on power distribution, street lighting and station control circuits and for general-purpose wiring on circuits up to 8000 volts between phases and at conductor temperatures up to 75 C. They will not crack after 3 hours in air containing .015 per cent ozone. They are light in weight, easy to install and join, and are resistant to oil, heat, sunlight, flame, acids, alkalis and corrosive chemicals. Uskorona-Neoprene cable also eliminates electrolysis. The following are guaranteed test values:

PHYSICAL AND AGING PROPERTIES (MINIMUM VALUES)

	Uskorona			Neoprene Jacket	
	Unaged	After 96 Hrs. O.B.	After 7 Day Geer Oven	Unaged	After 96 Hrs. O.B.
Tensile Lbs./Sq. In.	500	450	450	1800	1600
Elongation Per Cent	250	200	200	300	250

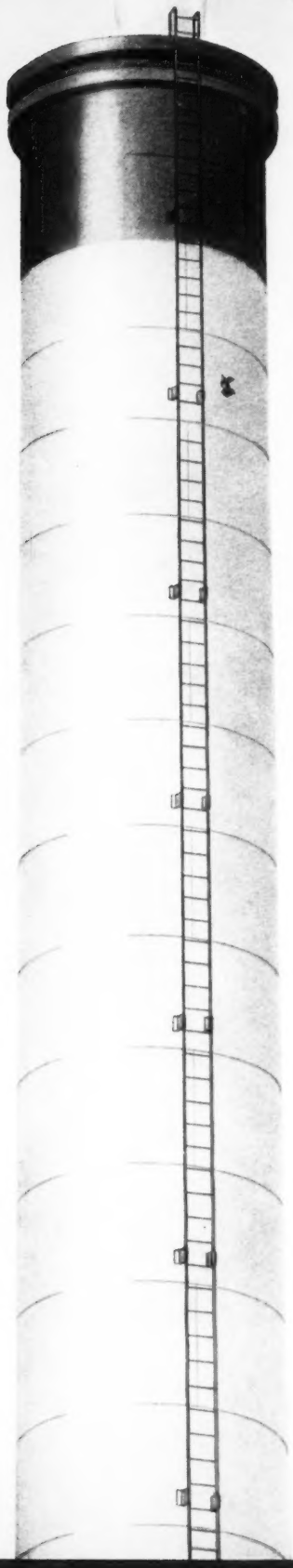
MOISTURE RESISTANCE (MAXIMUM VALUES)

Dielectric Constant and Power Factor of the insulation after immersion in water at 50 C.: Dielectric Constant, one day is 4.5; per cent gain, 1 to 14 days is 5.0; per cent gain, 7 to 14 days is 2.0; Power Factor, per cent, one day is 3.0; Stability Factor 40-80 volts/mil two weeks, per cent is .5.

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

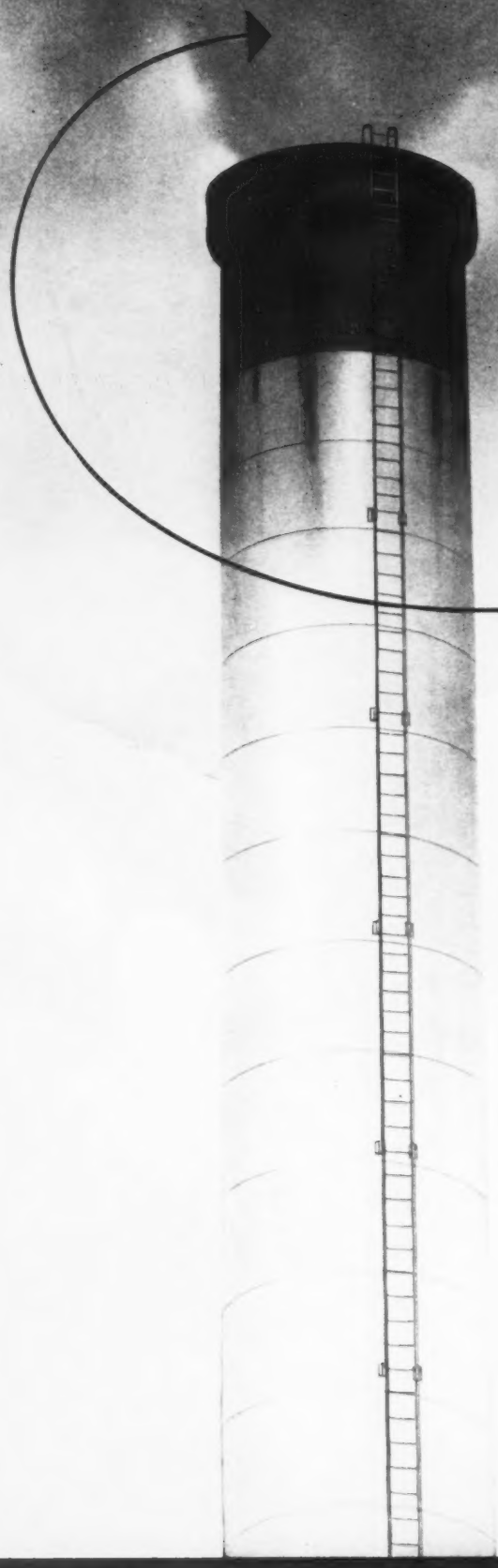
ELECTRICAL WIRE & CABLE DEPT. • ROCKEFELLER CENTER, NEW YORK 20, N. Y.



Please turn this page to see how this stack looked before the installation of an American Blower ST Fly Ash Precipitator.

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS HEATER



If your stack belches fly ash like this...

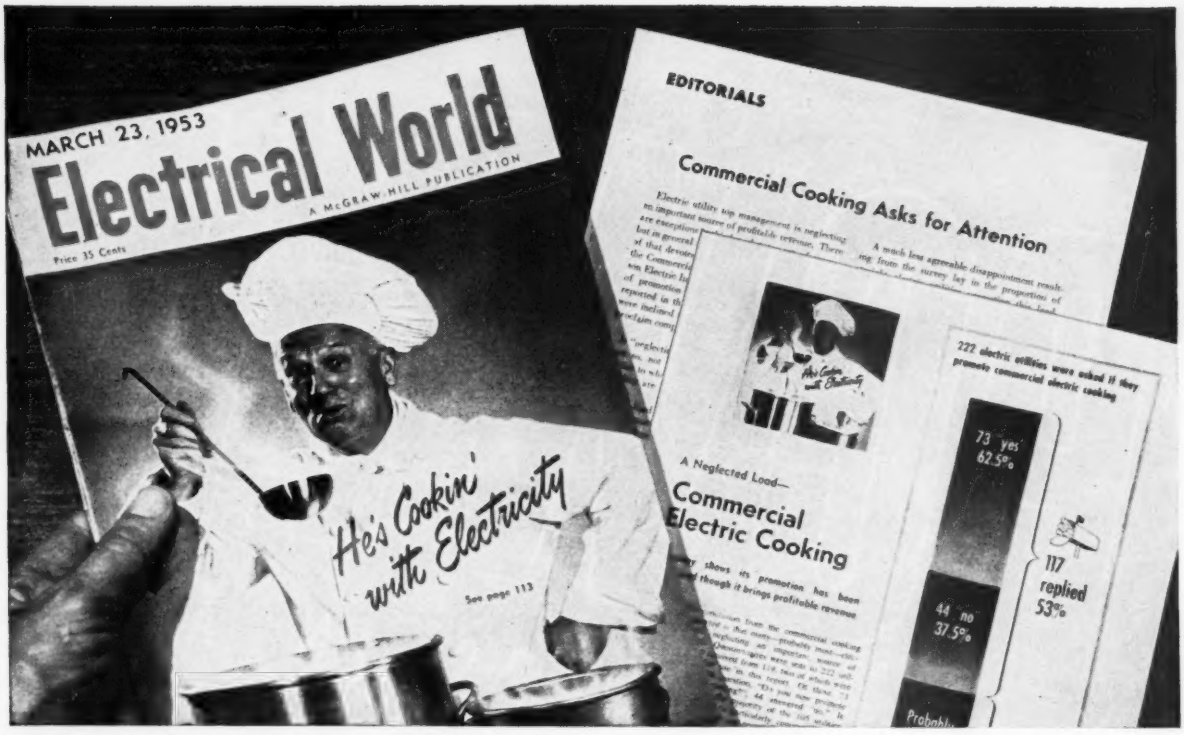
why not install an American Blower Type ST Fly Ash Precipitator now?

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary corporation

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS HEATER



Electrical World "lays it on the line"—

"Electric Utility Top Management is Neglecting an Important Source of Profitable Revenue"

So say *Electrical World* editors in their March 23rd issue, which published the findings of their survey of utility commercial cooking promotion. Read what else they had to say:

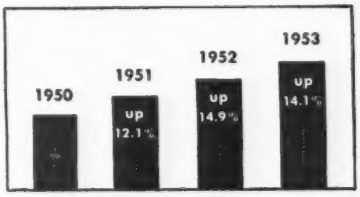
"Is 'neglecting' too strong a word? It does not seem so, not when less than one third of the utilities to whom the survey form was sent reply that they are promoting this load.

"Is this load a 'source of profitable revenue'? Taking demand and coincidence factors into account, the average of over $20 annual revenue per kilowatt of connected load . . . replies must mount up to a very happy figure relative to cost of system capacity required."

The editors conclude, "If commercial cooking were a difficult load to sell, if the cost of its acquisition were high in relation to its revenue potential, one could understand why it is not getting the attention it deserves. But it is not too hard to sell; and as the survey report shows, its annual revenue stacks up excellently against its sales expense."

Excerpts (at right) from *Electrical World's* survey prove just how fabulous a revenue-builder commercial cooking is—how comparatively little sales expense is needed to build it.

Why let this opportunity pass you by? Mail the coupon now for Hotpoint's proved promotion programs which have brought success to scores of utilities in building commercial cooking revenue.



"PROMOTION OF COMMERCIAL COOKING BUILDS DESIRABLE LOAD FAST," says *Electrical World*

Promotion pays off! Estimated connected load data received from reporting utilities shows a *12 to 15% annual increase.* These utilities now average *$½ million in added revenue* a year!

OTHER *ELECTRICAL WORLD* FINDINGS—

- EAR per dollar of sales expense averaged $14.44. EAR per kw of new commercial load averaged $25.72.
- "The load is good—it's even and to a large degree off-peak. And customer satisfaction is high."
- "Commercial cooking revenue rises faster (10 to 14% annually) than *total* industrial and commercial revenue (7.5% in 1952)."

Hotpoint Co., Commercial Equipment Dept.
265 South Seeley Ave., Chicago 12, Illinois

☐ Please send me a reprint of Electrical World's article on commercial cooking.
☐ Please send me details of Hotpoint's commercial cooking promotion program.

NAME_____

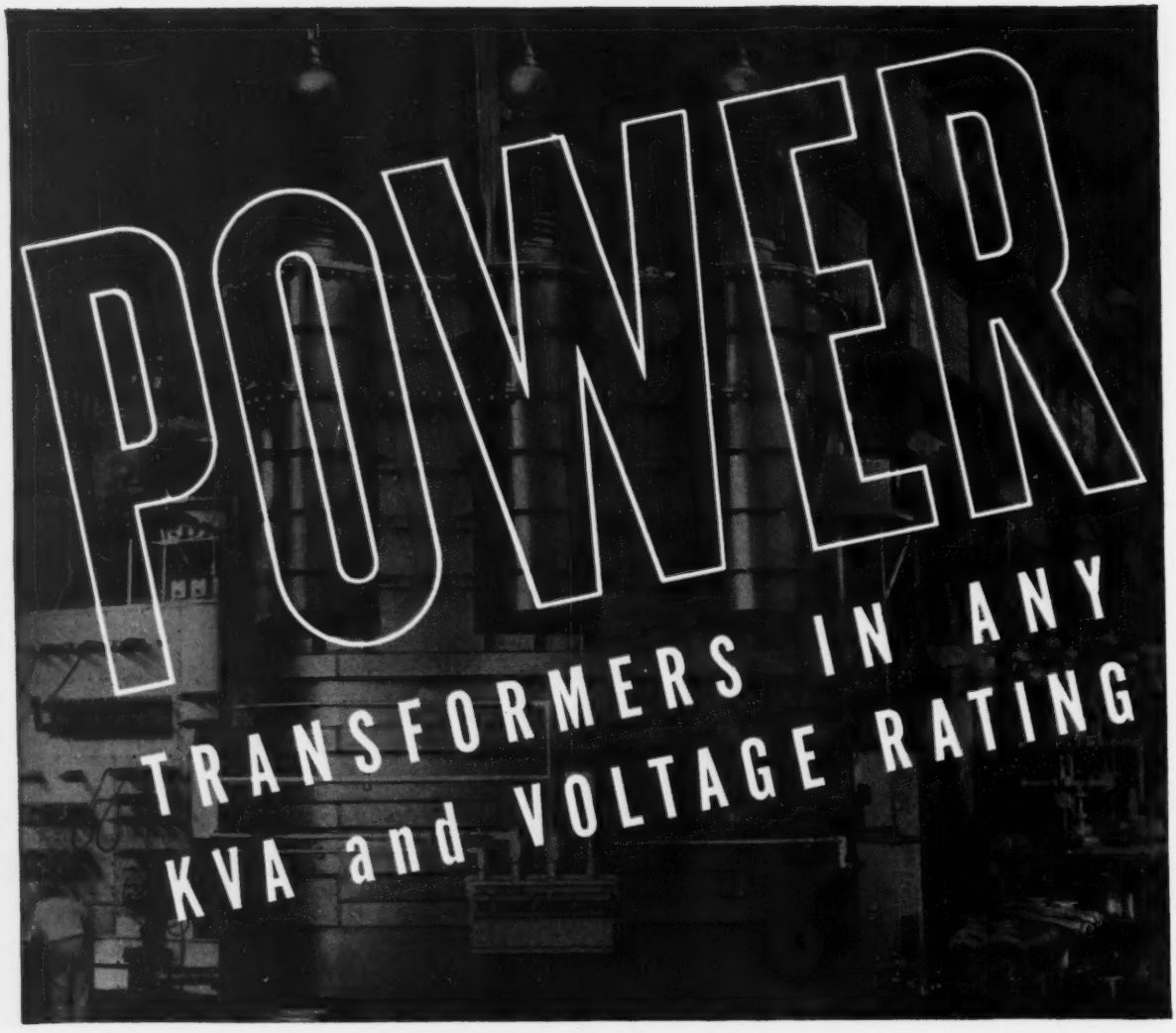
COMPANY_____

ADDRESS_____

CITY_____ STATE_____

Hotpoint ALL-ELECTRIC Commercial Cooking

HOTPOINT CO., A Division of General Electric Company



MOLONEY has the capacity to manufacture power transformers of any Kva and voltage rating. When utilities and industrials use Moloney equipment, they obtain the benefits of all the experience and knowhow of over 57 years of engineering, designing and fabricating transformers. This experience produces a better transformer, which, when installed, will give better performance, have greater reliability and require less maintenance. For further information contact your nearest Moloney representative.

ME 53-9

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

MOLONEY ELECTRIC = { BETTER PERFORMANCE / GREATER RELIABILITY / LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

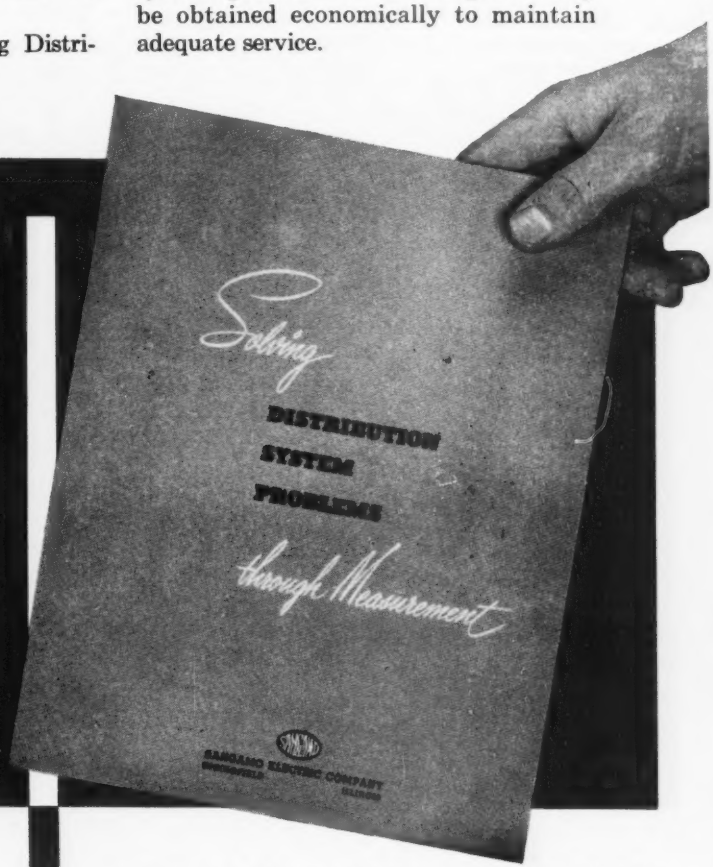
NEW Booklet on Measurement for DISTRIBUTION ENGINEERS

Distribution engineers are daily faced with the complex problem of how to utilize fully the capacity of their present equipment to meet today's ever increasing loads.

The solution of this problem requires specific knowledge of the factors involved. Periodic surveys are costly and do not provide the complete, *continuous* information which can be obtained only by measurement.

Sangamo's new booklet "Solving Distribution System Problems Through Measurement" tells how a number of utilities have solved this problem with permanent installations of Sangamo Thermal Meters for continuous measurement. It tells what types of instruments to use to measure ampere loading in the substation and on the distribution system . . . how KW and KVAR measurements help attain efficient system operation . . . how voltage data may be obtained economically to maintain adequate service.

Here is the answer to your load growth problems. Just clip the coupon for your copy of "Solving Distribution System Problems Through Measurement." No obligation.



SANGAMO

Only Measured Facts are Known Facts

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SANGAMO ELECTRIC COMPANY, SPRINGFIELD, ILLINOIS

Send my copy of "Solving Distribution System Problems Through Measurement"

YOUR NAME_____

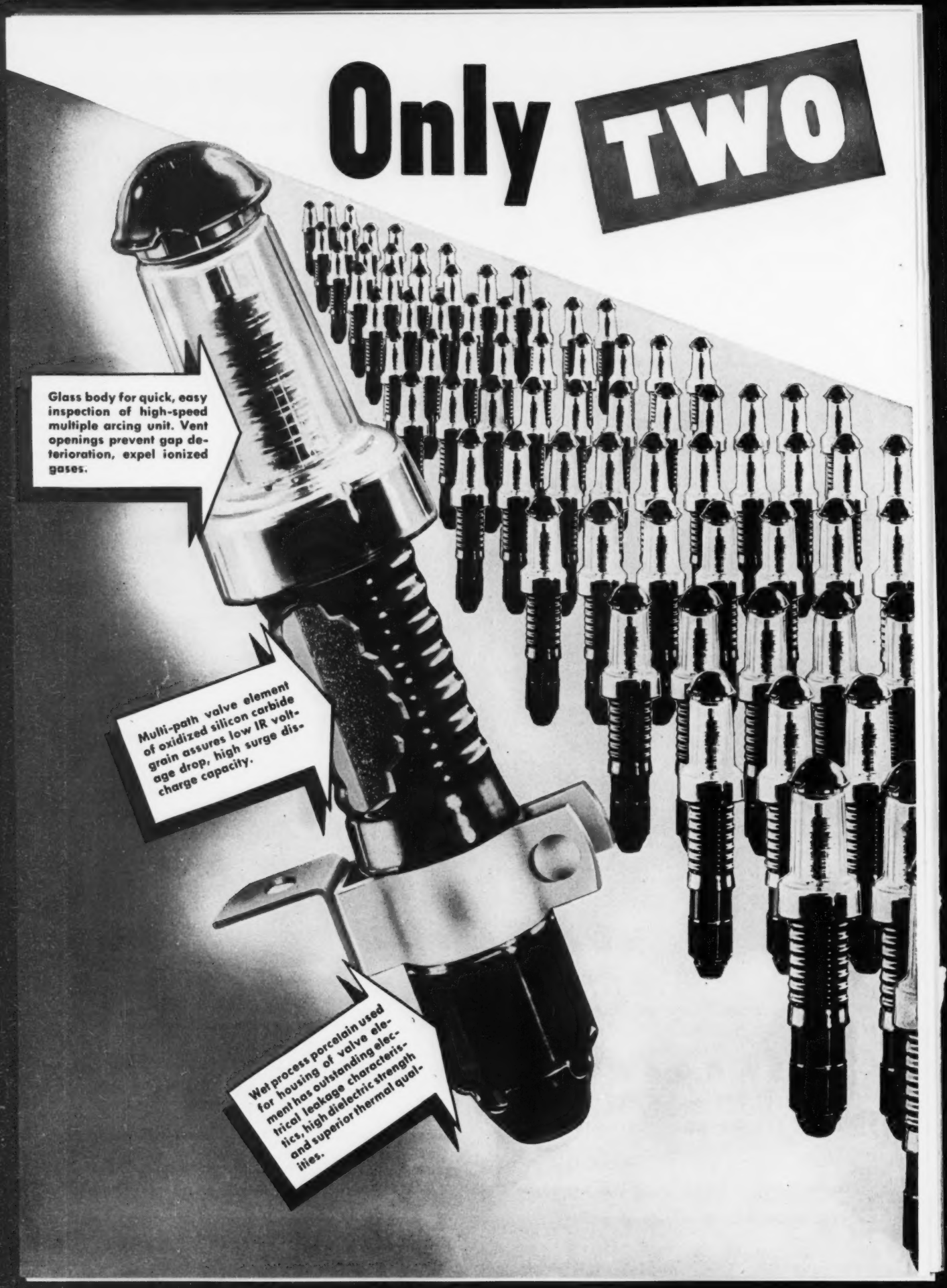
TITLE_____

COMPANY_____

CITY and ZONE_____ STATE_____

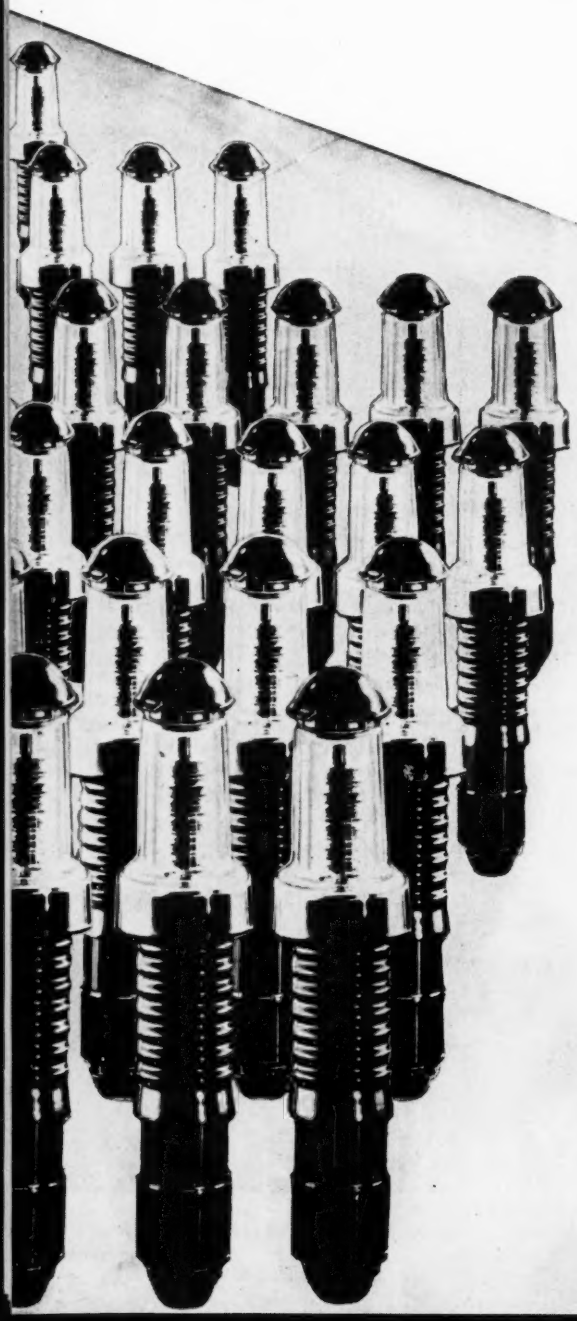
SM53-4

Only TWO


Glass body for quick, easy inspection of high-speed multiple arcing unit. Vent openings prevent gap deterioration, expel ionized gases.
Multi-path valve element of oxidized silicon carbide grain assures low IR voltage drop, high surge discharge capacity.
Wet process porcelain used for housing of valve element has outstanding electrical leakage characteristics, high dielectric strength and superior thermal qualities.

in 500,000

LIGHTNING ARRESTER YEARS



ONLY TWO FAILURES MAR PERFECT RECORD OF TIME-PROVED DEPENDABILITY

Throughout 500,000 lightning arrester years, only two Crystal Valve Ventilated Gap Lightning Arresters have ever failed. Thousands upon thousands have given year after year of trouble-free protection, under every operating condition, all over the world.

First introduced in 1936, this time-tested arrester has never required any major change in design. Today, as then, gap ventilation assures freedom from gap corrosion . . . interior is always clean and dry. Vents expel conductive ionized gases, bring in fresh air for high resistance to circuit current.

The same "Ultra-speed" gap is still service-engineered to be the fastest gap in the industry. The same oxidized silicon carbide grain provides a multi-path valve element for quick uniform distribution of surge discharge and fast suppression of follow current.

Crystal Valves combine every modern scientific advancement with the time-proved reliability of the vented gap. For dependable protection, under every weather and lightning condition, install Crystal Valve Ventilated Gap Arresters on every transformer.

Write today for illustrated folder with full details

ELECTRIC SERVICE MANUFACTURING CO.

PHILADELPHIA 32, PA.

Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto

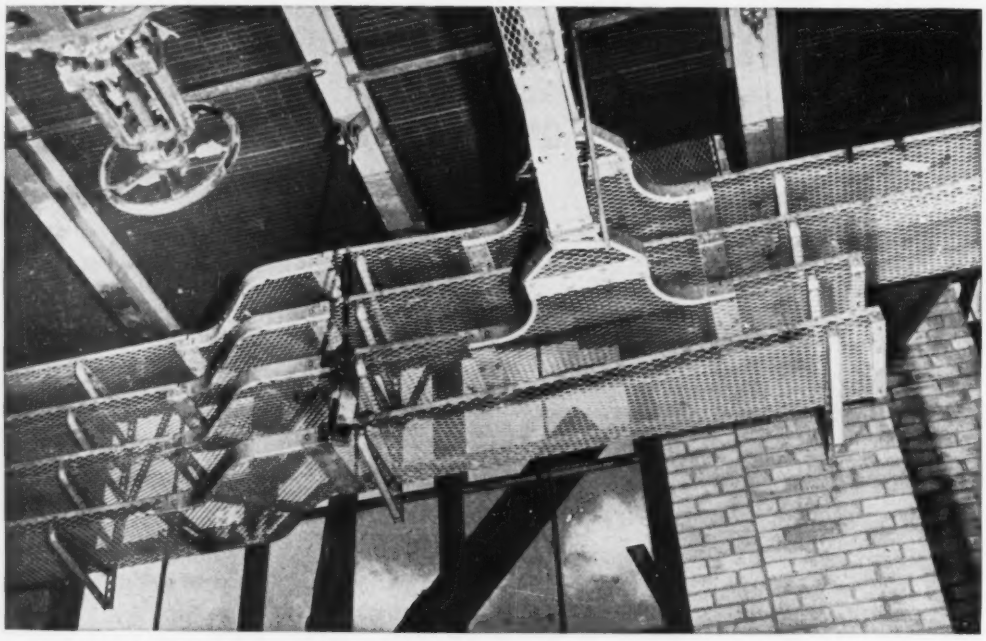
CRYSTAL VALVE
Ventilated Gap
LIGHTNING ARRESTERS

Service Engineered by **ELECTRIC SERVICE**

T. J. COPE, INC.

711 SOUTH 50TH STREET, PHILADELPHIA 43, PA.

Standard systems of trough and fittings for supporting power and control cable.
— For over 65 years, Manufacturers of Tools and Equipment for
Installation of Underground and Overhead Electric Cables



Cope Cable Trough installed at Jersey Central Power and Light Company, E. H. Werner Station, South Amboy, New Jersey, Burns and Roe, Engineers and Constructors; Hatzel and Buehler, Electrical Contractors.

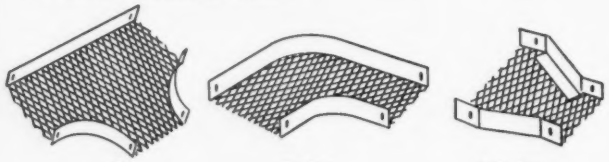
The Cope Standardized System of Cable Trough offers a simple, sturdy, time and labor saving construction for the support of electrical power and control cable. It is widely accepted by leading engineers and contractors as is indicated by an impressive list of outstanding installations.

Practically any layout problem can be met. Sturdy raceways of varying widths, at different levels and in any direction are easily installed. They can pass around, over or under obstructions and change from one size trough to another. For very unusual conditions, special fittings can be designed and fabricated.

Standard straight trough is in 8′ lengths and in 6″, 12″, 18″, and 24″ widths. All are 3″ high including steel binding strip. Covers are also available. Assembly requires only the use of nuts and bolts which are supplied. All parts are hot dip galvanized. Write for Bulletin 65A for full details.

COPE STANDARD FITTINGS

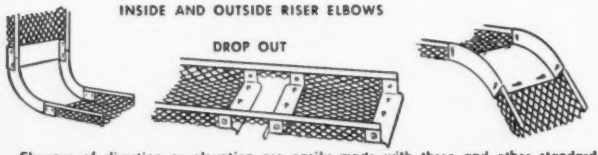
. . . in the Horizontal Plane



TEE ELBOW REDUCER

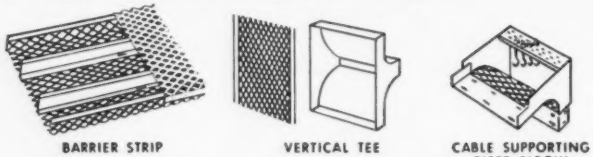
All fittings have radius corners to protect the cable from damage during installation and insure a neat finished job.

. . . in the Vertical Plane



Changes of direction or elevation are easily made with these and other standard fittings shown in Bulletin 65A. Write for it.

. . . Barrier Strips and Miscellaneous Fittings



BARRIER STRIP VERTICAL TEE CABLE SUPPORTING RISER ELBOW

New Outdoor Current Transformer IS LIGHTER, TAKES LESS SPACE

COMPARE THESE FIGURES

KV	DESIGN	FLOOR SPACE	HEIGHT	GAL. OIL	WEIGHT (lbs.)
25	New Type SCW	14" x 19"	42"	9	230
	Previous Type	22" x 22"	33"	15	490
34.5	New Type SCW	14" x 19"	45"	9½	230
	Previous Type	22" x 22"	33"	15	490
46	New Type SCW	16" x 23"	55"	16	475
	Previous Type	23" x 23"	40½"	18½	500
69	New Type SCW	16" x 23"	61"	18	525
	Previous Type	28½" x 28½"	46½"	35	1000

ALLIS-CHALMERS INSTRUMENT TRANSFORMERS

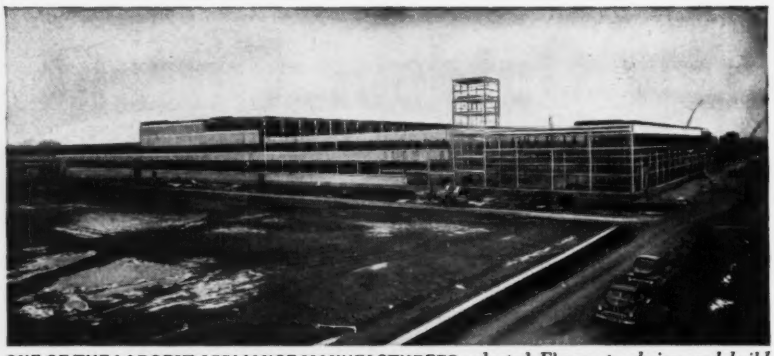
Here is a completely new line of current transformers for outdoor use on power circuits 69 kv and below. They bring you many new design features that result in excellent performance, high thermal and mechanical strength, plus mechanical advantages that simplify installation.

Most important, their ruggedness has been proved by exhaustive tests. Temperature rise at normal current is low, allowing ample overcurrent in emergencies. The transformers are rated 65 times normal primary current under short circuit conditions. Corona-free design extends insulation life.

For the complete story get your copy of the paper "Progress in Instrument Transformer Design" by writing Allis-Chalmers, Milwaukee 1, Wisconsin. A-4110

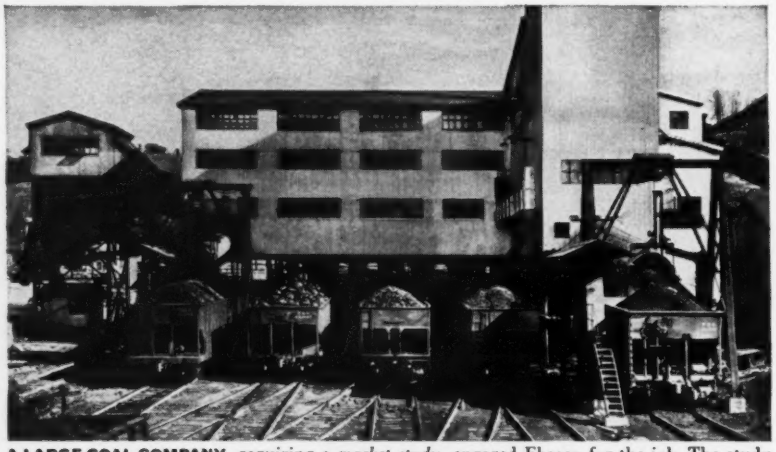
ALLIS-CHALMERS

A LUMBER COMPANY called in Ebasco specialists to make an *engineering study*. Providing an unbiased outside viewpoint, the study was used to improve lumbering operations.



ONE OF THE LARGEST APPLIANCE MANUFACTURERS selected Ebasco to *design and build* this giant plant at Columbus, Ohio. When completed, it will be nearly half a mile long and capable of turning out 4,500 refrigerators a day.

A BAKING CONCERN required assistance in making a *financial study*. Rather than add financial specialists to its permanent payroll, they called in Ebasco to do the job.



A LARGE COAL COMPANY, requiring a *market study*, engaged Ebasco for the job. The study analyzed changes in the anthracite market, the company's dealer and sales organization, sales outlets, possible new uses and markets for anthracite. Ebasco has made sales and marketing studies of both wholesale and consumer markets in many other fields of business.

HOW BUSINESS AND INDUSTRY GET EXTRA MANPOWER

A ROPE COMPANY engaged Ebasco to make a *business study* of its operations. This Ebasco report provided management of the company with a workable "blueprint for future action."

Companies Call on Outside Specialists to Solve Special Problems

As industry grows, so do the problems industry faces. These problems are just as common—and just as complex—to small firms as they are to large corporations. That's why companies of different sizes, in different fields, call on Ebasco to supplement the personnel of their own organizations.

Ebasco specialists—men whose technical talents are at a premium in today's tight manpower market—provide these companies with required services without adding to permanent payrolls, over-burdening busy staffs or wasting the valuable time of top executives.

Perhaps Ebasco can provide extra manpower to help solve *your* special business problems. For your copy of our booklet, "The Inside Story of Outside Help," write: Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

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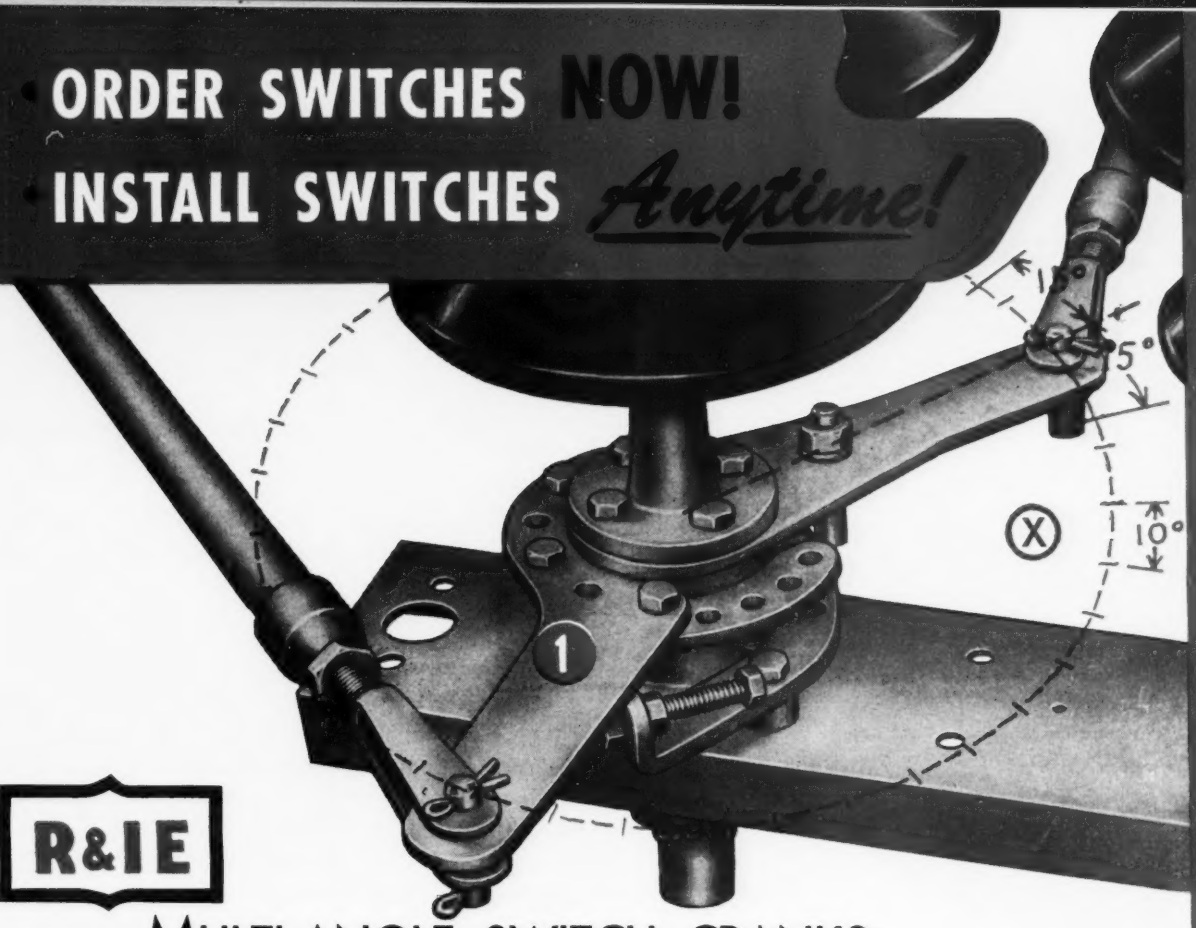
Ebasco Teamwork gets things done anywhere in the world

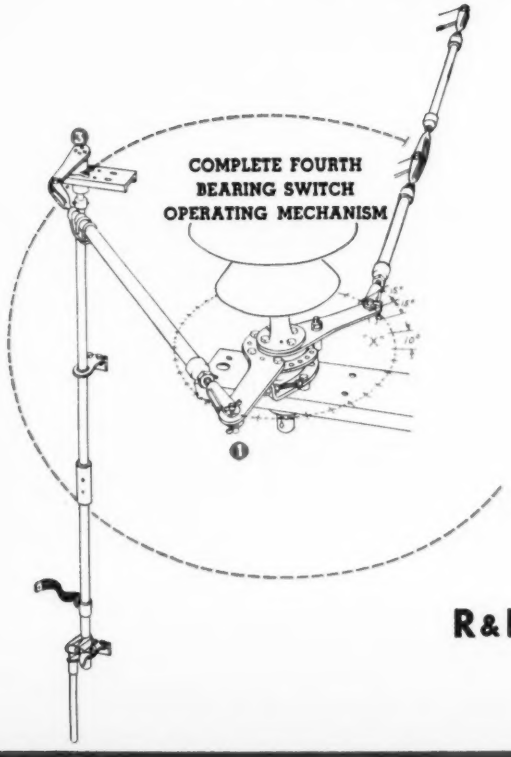
ORDER SWITCHES NOW!
INSTALL SWITCHES *Anytime!*



R&IE

MULTI-ANGLE SWITCH CRANKS

Save Engineering and Installation Time!



CHECK THE FACTS

1. **UNIVERSALLY ADJUSTABLE**—Movable crank permits angular adjustment, in 10 degree steps (X), to within 5 degrees of desired operating location of crank.
2. **NO WAITING FOR FINAL STRUCTURAL DETAILS** to order switches. Adjustable features of crank permit switches to be installed at any time on any type structure.
3. **RANGE OF POSITION.** Unlimited to within 15 degrees of interphase crank, (as shown above). Fourth bearing can be placed in any desired position on the structure.

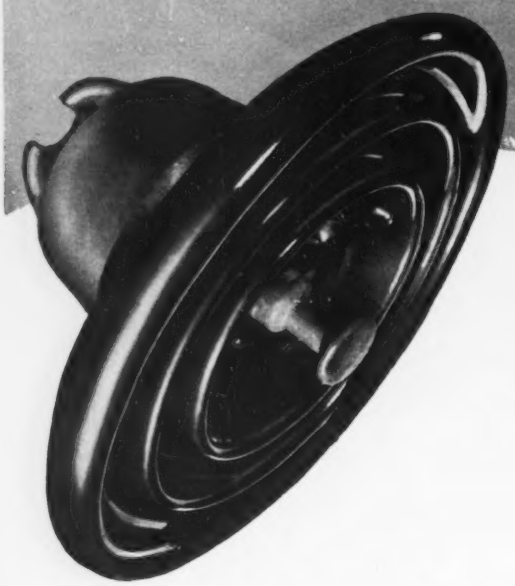
More details in Bulletin 1405B. Learn how to save valuable time.

R&IE SWITCHING EQUIPMENT
DIVISION OF I-T-E CIRCUIT BREAKER CO.,
GREENSBURG, PENNA.

STRUCTURES—steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED-PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION

new Thomas "Chip-Proof" insulator



A new corrugation design positively prevents chipping or breaking of inner petticoats. This protection is assured by eliminating the destructive bumping of caps or clamp fittings against the petticoats, yet gives complete interchangeability with all current designs as required by NEMA Standards. Only this new Thomas design (Patent applied for) can guarantee the virtual impossibility of damaging inner petticoats by rough handling during assembly or disassembly in the field.

● Naturally, we are excited. We believe our new petticoat design to be the answer to the insulator breakage problem, during construction, which has plagued the Industry for years. This design accomplishes positive elimination of insulator breakage during construction due to rough handling in coupling and uncoupling insulator units and in installing hardware fittings to the insulator strings.

Of course, the greatest benefit of this new design will be realized with the close-coupled units, but for all insulator spacings, our new design assures more ruggedness with resulting longer life . . . and at no additional cost to you!

The foregoing are bold statements. However, our most severe tests prove them and they are too important for you not to verify.

We suggest that you order TODAY, a standard crate of 6—No. 21239 THOMAS 1953-DESIGN SUSPENSION INSUALTORS. Test them thoroughly . . . and compare with other close-coupled designs.

The R. Thomas and Sons Co.

1873 THOMAS INSULATORS our 80th year RELIABILITY 1953

LISBON, OHIO
NEW YORK CHICAGO

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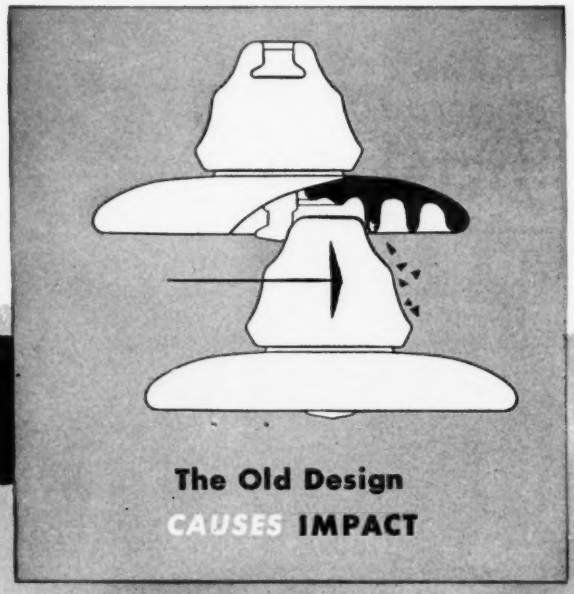
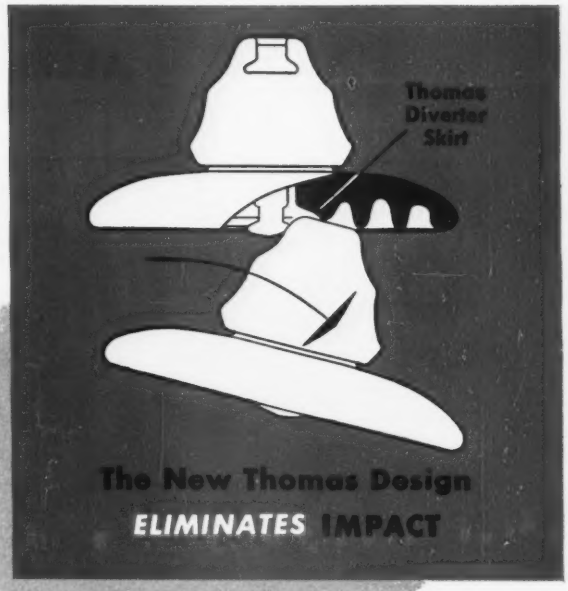


The Old Design
CAUSES IMPACT



The New Thomas Design
ELIMINATES IMPACT

eliminate *Impact*

and you eliminate breakage

For many years, The R. Thomas and Sons Company has been well aware of the insulator breakage problem during construction. But none of us imagined the solution to be so simple and yet so effective.

Examine carefully the two drawings above. Note that with the OLD design (illustrated at the left) when the lower insulator is uncoupled, it can easily be SLAMMED directly in a straight line against the innermost petticoat. Obviously, this action results in a chipping or breaking IMPACT.

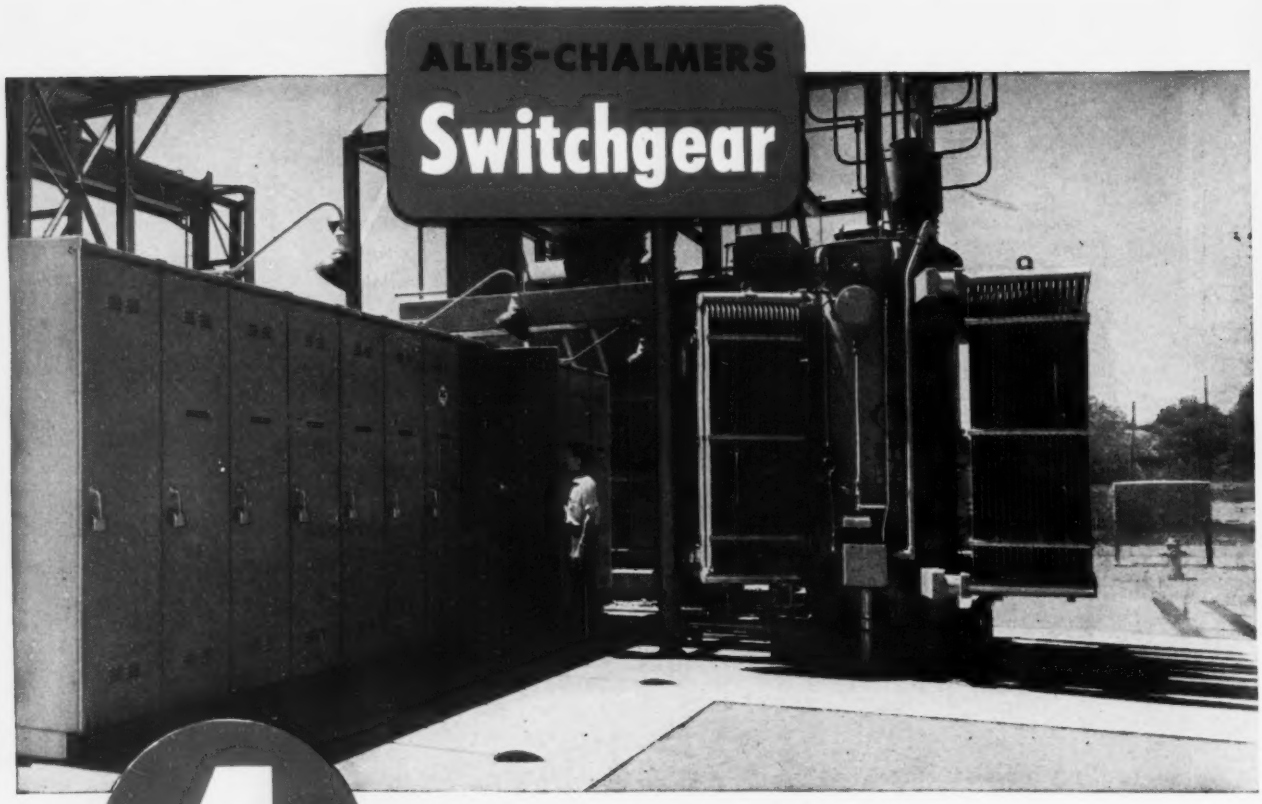
Now note how the THOMAS DIVERTER skirt (illustrated at the right above) eliminates impact. This DIVERTER skirt (Patent applied for) is simply a heavy corrugation designed with a contour that *diverts* the lower insulator or fittings away from any petticoats.

No matter how roughly the insulators are handled, when the cap is pulled off the ball pin, it will first strike the DIVERTER which it cannot break. This glancing blow will deflect any destructive IMPACT from the lighter petticoats. Simple . . . but EFFECTIVE.

All standard Thomas 10-inch suspension insulators now have this feature . . . at no extra cost.

Specify THOMAS INSULATORS—THE BEST BY LINE TEST

The R. Thomas and Sons Company is a manufacturer and designer of all types of porcelain insulators . . . pin-type, switch, suspension, spools, guy-strain, bushings and special high-voltage porcelain. In addition, Thomas supplies associated line hardware, clamps, fittings, and so on.



4 WAYS to Guard Against Power Interruption

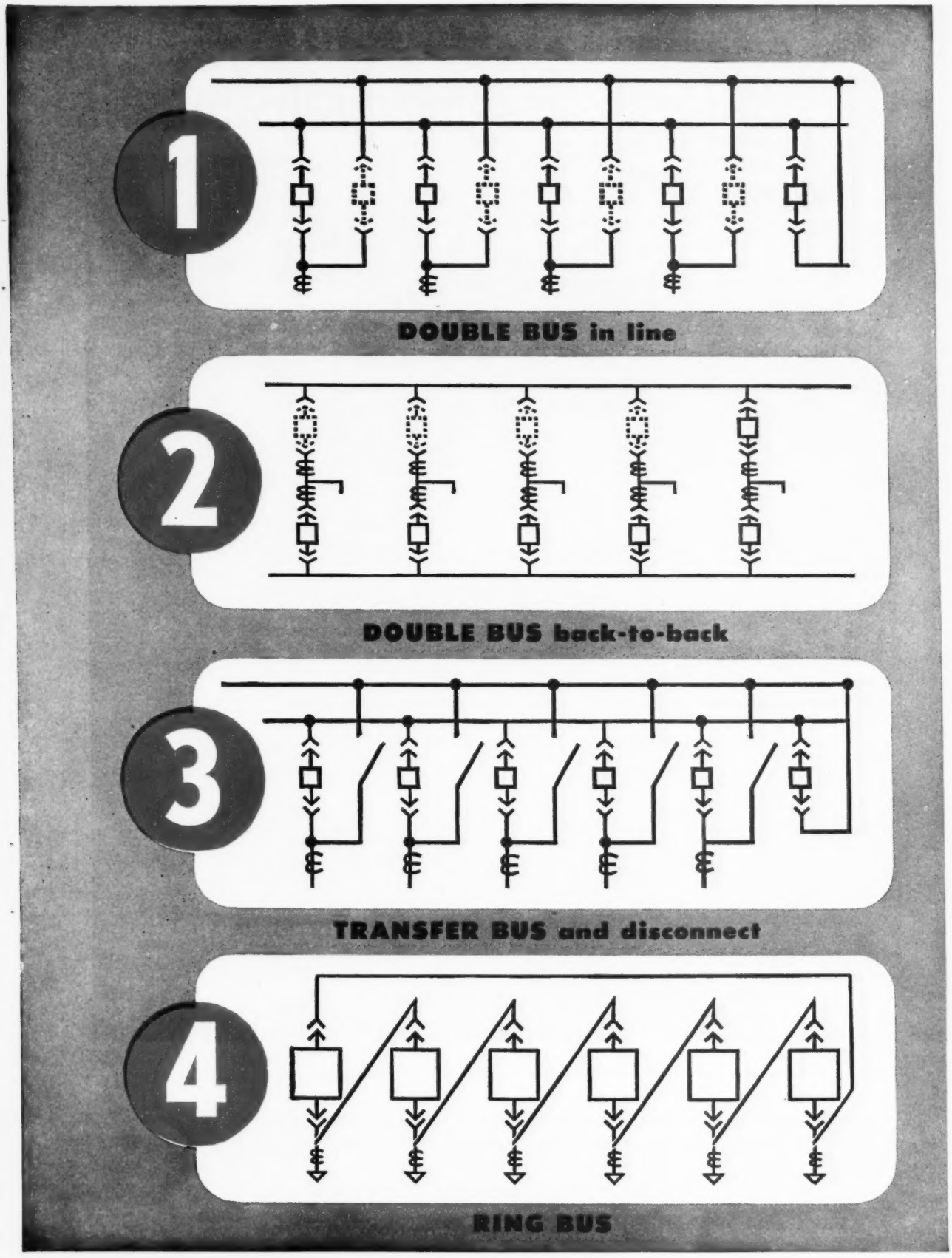
Here are a few of the many different circuit arrangements Allis-Chalmers can provide. All are designed to assure continuity of service. Each one is specially suited for specific situations.

With Allis-Chalmers switchgear, all these circuit schemes have one advantage in common. Each arrangement shown can be built into standard units of Allis-Chalmers metal-clad switchgear without adding extra cubicles. This economy and simplicity, plus the obvious space savings, make Allis-Chalmers equipment especially attractive.

Which Arrangement is Best? A study of your problem is needed to answer this question. Any one of these arrangements may be best for your plant. Or maybe an entirely different scheme is needed. In any case, Allis-Chalmers engineers can help you work out the best scheme for you . . . one that provides ✓economy, ✓simplicity, ✓space saving, and ✓uninterrupted service.

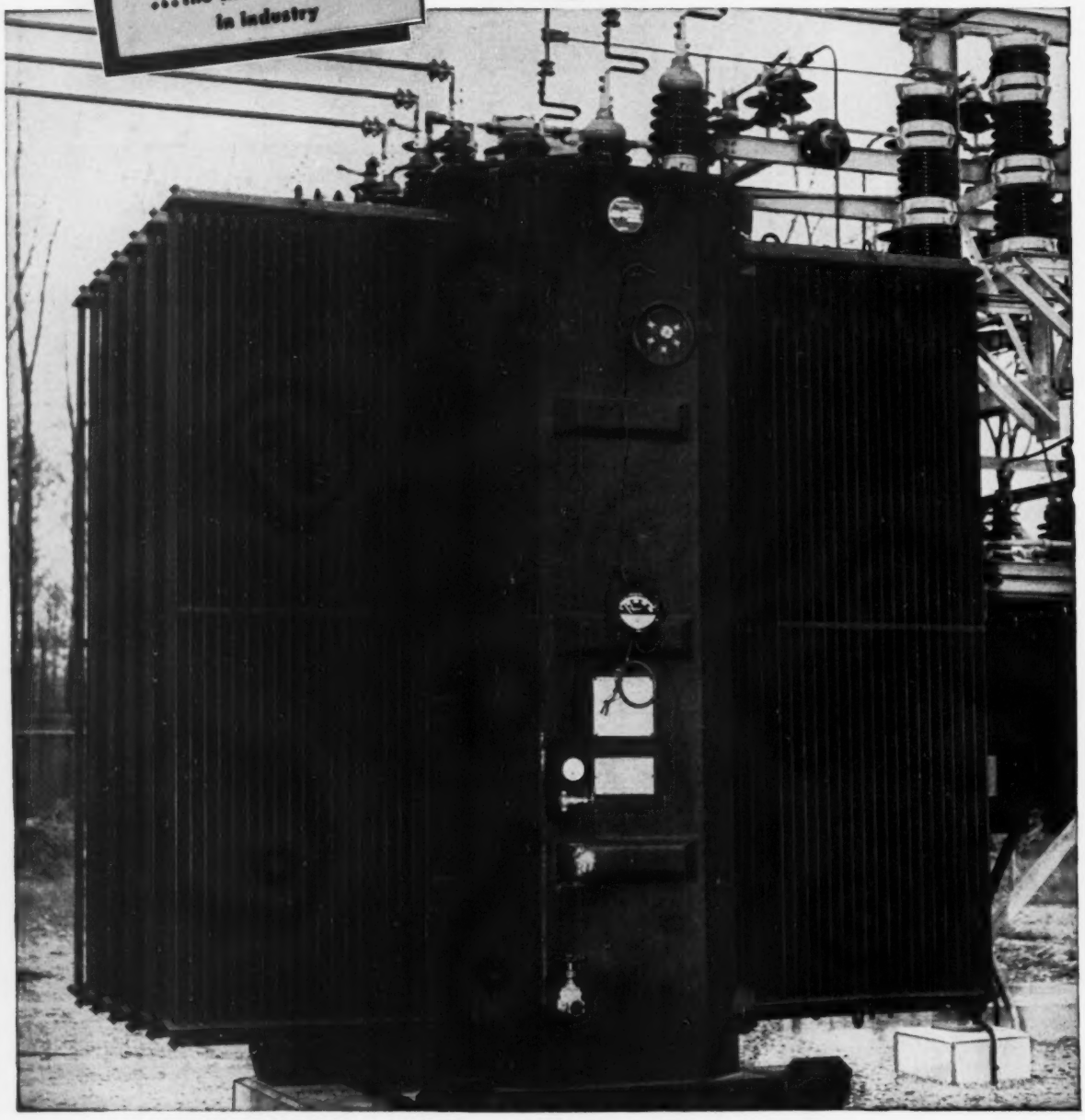
For complete information, call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4135

ALLIS-CHALMERS


1
DOUBLE BUS in line
2
DOUBLE BUS back-to-back
3
TRANSFER BUS and disconnect
4
RING BUS

Wagner
TRANSFORMERS
...the choice of leaders
in industry

Wagner Transformers



6000 KVA WAGNER POWER TRANSFORMER, outside the Studebaker Plant, where power is received at 26.4 kv and is stepped down to 13.2 kv for distribution to the seven unit substations in the plant.

Wagner transformers were chosen for this installation, as they are for many industrial and power company installations, because of their ability to give adequate and reliable service over unusually long periods of time.

Why not discuss your next transformer installation with the Wagner engineer nearest you? There are Wagner branches in 32 principal cities. Bulletin TU-181 gives full information on Wagner Power Transformers, and Bulletins TU-13 and TU-56 tell about Wagner Unit Substation Transformers. Write for your copies.

used by Studebaker in new power distribution system planned for present and future needs

New Jersey plant can convert from military to auto assembly production without extensive system changes!

The modern power distribution system at the Studebaker Corporation plant at New Brunswick, New Jersey, has been planned with an eye to the future. While the plant is now manufacturing military jet engine parts, it will eventually become eastern auto assembly headquarters for Studebaker.

For this reason, the power load is divided between seven load center substations, all equipped with Wagner Unit Substation Transformers, spaced 160 feet apart down the center of the building. In addition to insuring an adequate power supply for present purposes, this plan provides a dependable supply of power from short secondary feeders at any time in the future. No extensive system changes will be required at the time of plant conversion.

500 KVA WAGNER TRANSFORMER with switchgear, one of two such units that supply 208Y/120 three phase power for lighting and other small power loads.

1000 KVA WAGNER UNIT SUBSTATION TRANSFORMER, at one of the five load centers that deliver 480 volt, three phase power to large machines and equipment.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

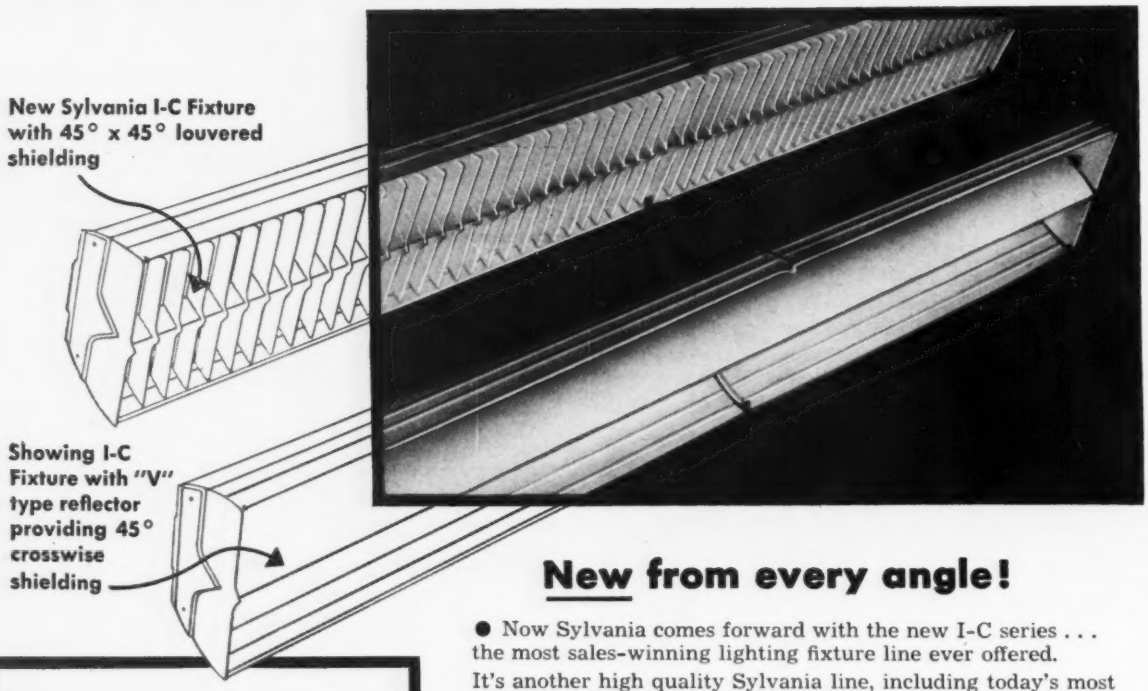
Wagner Electric Corporation EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

T53-10

Sylvania Announces! A New Industrial-Commercial Fluorescent Fixture Line!


New Sylvania I-C Fixture with 45° x 45° louvered shielding
Showing I-C Fixture with "V" type reflector providing 45° crosswise shielding

New from every angle!

● Now Sylvania comes forward with the new I-C series . . . the most sales-winning lighting fixture line ever offered.

It's another high quality Sylvania line, including today's most wanted features. Amazingly versatile, too, with 4, 5, and 8 foot units specifically designed to meet the lighting needs of offices, stores, schools and factories. Ideal for critical seeing tasks such as those encountered at printing plant composing stones or in the machining of specular metals.

And, it's a right-priced line offering new business opportunities to your architect, builder, and electrical-contractor friends . . . for both *industrial and commercial applications.*

Remember, this Sylvania I-C line is designed, built and tested and *fully guaranteed* for one year by Sylvania. For detailed information see your Sylvania representative or write directly to: Sylvania Electric Products Inc., Dept. 3X-2711, 1740 Broadway, New York 19, N. Y.

Quality built and packed with these advanced features:

45° x 45° Louvered Shielding—Direct Glare is kept to a minimum when 45° x 45° louver shielding is used.

60%-40% Distribution — Distribution from I-C fixtures is 60% downward and 40% upward, providing a strong direct component for high levels of illumination.

Versatile and rugged, too! — Channels are die-formed of 20-gauge steel. Made with extra knockouts to provide flexibility of installation. Designed for individual or continuous-row installations, pendant or surface mounting. Metal parts Bonderite treated to resist deterioration. Channels, louvers and steel panels finished in Sylvania's high-temperature baked Miracoat, providing 86% reflectivity.

T-17 Low Brightness Unit — The I-C line has been designed to accommodate the 40-watt 60-inch T-17 low-brightness lamp, meeting the need for a unit with minimum shielding. Combines low brightness, comfortable illumination with high efficiency and easy maintenance.

SYLVANIA

LIGHTING • RADIO • ELECTRONICS • TELEVISION

In Canada: Sylvania Electric (Canada) Ltd.
University Tower Building, St. Catherine Street, Montreal, P. Q.

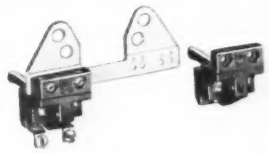
EXTRA AUXILIARY CONTACTS

for ALL Allen-Bradley Starters . . . Sizes 0 to 7

Auxiliary Contacts—Sizes 0 & 1

NOW . . . it's easy to add auxiliary contacts to A-B solenoid starters to operate extra relays, pilot lights, or other accessories. Just follow the steps shown below.

Bulletin 895 auxiliary contacts come in forms to fit all sizes of starters . . . with either single pole normally open, normally closed, or normally open-normally closed contacts. They can be added to any A-B starter in stock or in service.



Auxiliary Contacts—Sizes 2 & 3

ADD ONE OR TWO AUXILIARY CONTACTS TO ANY A-B SOLENOID STARTER

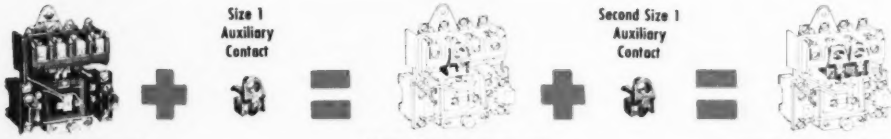
Bulletin 709 Size 0 starter with auxiliary lock-in contact

Bulletin 709 Size 0 starter with one extra auxiliary contact

Bulletin 709 Size 0 starter with two extra auxiliary contacts

SIZE 0 STARTER

One or two extra auxiliary contacts can be mounted on Size 0 arc hood. Terminals are easily accessible from front. Rugged—simple—trouble free.



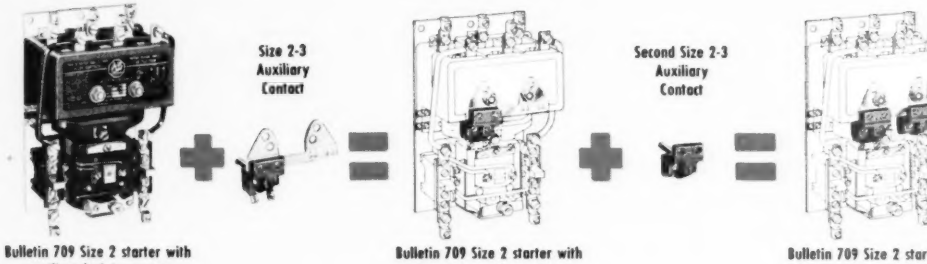
Bulletin 709 Size 1 starter with auxiliary lock-in contact

Bulletin 709 Size 1 starter with one extra auxiliary contact

Bulletin 709 Size 1 starter with two extra auxiliary contacts

SIZE 1 STARTER

One or two extra auxiliary contacts can be mounted on Size 1 arc hood. Terminals are accessible from front. Existing wiring not disturbed in any way.



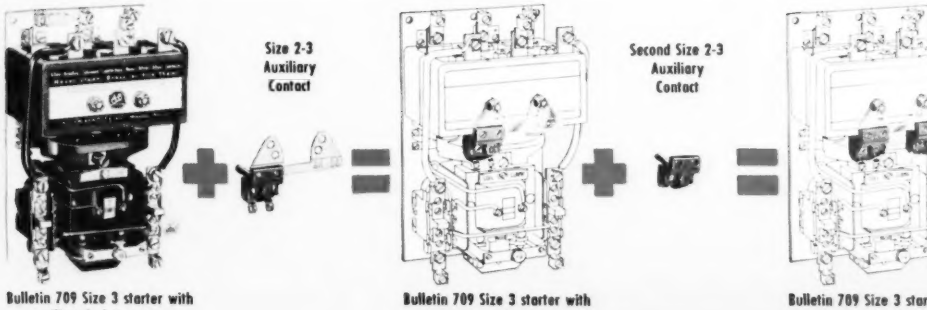
Bulletin 709 Size 2 starter with auxiliary lock-in contact

Bulletin 709 Size 2 starter with one extra auxiliary contact

Bulletin 709 Size 2 starter with two extra auxiliary contacts

SIZE 2 STARTER

Mounting plate will hold one or two extra Size 2-3 auxiliary contacts. It is attached to starter using existing arc hood threaded studs and lock nuts. Solenoid plunger of starter actuates the auxiliary contacts.



Bulletin 709 Size 3 starter with auxiliary lock-in contact

Bulletin 709 Size 3 starter with one extra auxiliary contact

Bulletin 709 Size 3 starter with two extra auxiliary contacts

SIZE 3 STARTER

The Size 2-3 mounting plate will also fit the Size 3 arc hood and support one or two auxiliary contacts. Easy to install and simple to operate. Trouble free performance is guaranteed. No contact maintenance.

Contact arrangements are readily changed from normally open to normally closed, or vice versa. This flexibility opens new possibilities for applying Allen-Bradley contactors and starters to automatically controlled equipment.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

A-B Quality

ALLEN-BRADLEY

MOTOR CONTROL

8-53-MR

MAKE YOUR OWN TERMINAL STRIPS

with these handy

BULLETIN 892 TERMINAL BLOCKS

EASILY MADE UP IN ANY LENGTH TO MEET YOUR TERMINAL STRIP SPECIFICATIONS

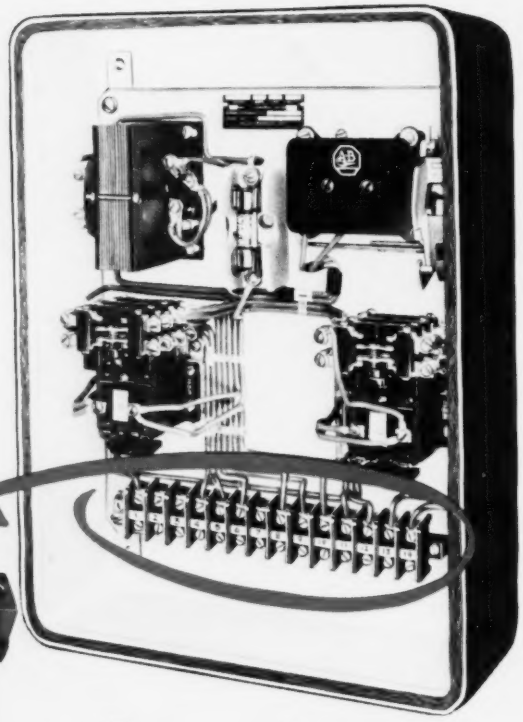
Bulletin 892 terminal blocks interlock in perfect alignment to provide the exact number of terminals for any panel board. There are no excess terminals—hence, no waste of panel space. The required terminal strip can be assembled quickly and mounted on the panel with hold-down bolts. Plastic barriers separate the clamp-type terminals which have lock washers.

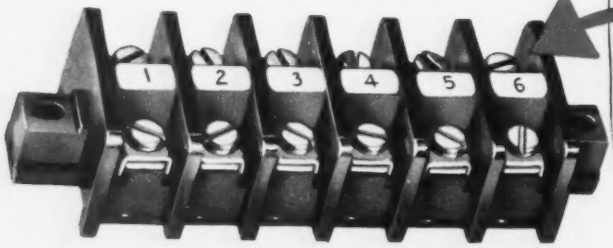
One end block and any number of terminal blocks may be hooked together. In general, every 13th block is used to secure a long terminal strip to the panel.

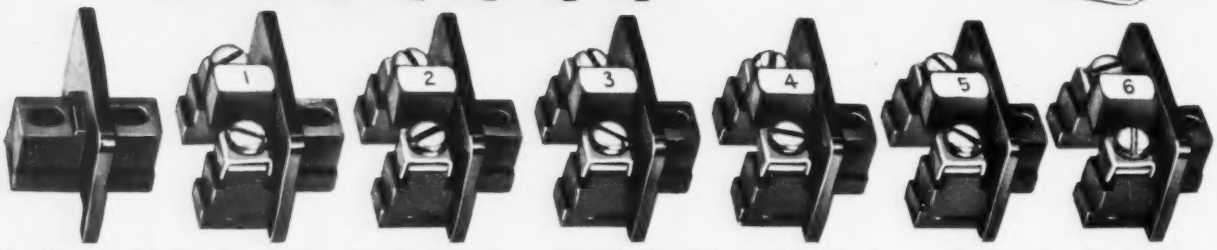
AVAILABLE IN TWO CURRENT RATINGS
15 AMPERES—25 AMPERES

Dimensions of Bulletin 892 Terminal Blocks

Ampere Rating	Width	Height	Over-all Length of 10 Blocks
15	1½"	1"	7"
25	1⅞"	1⅛"	8⅛"







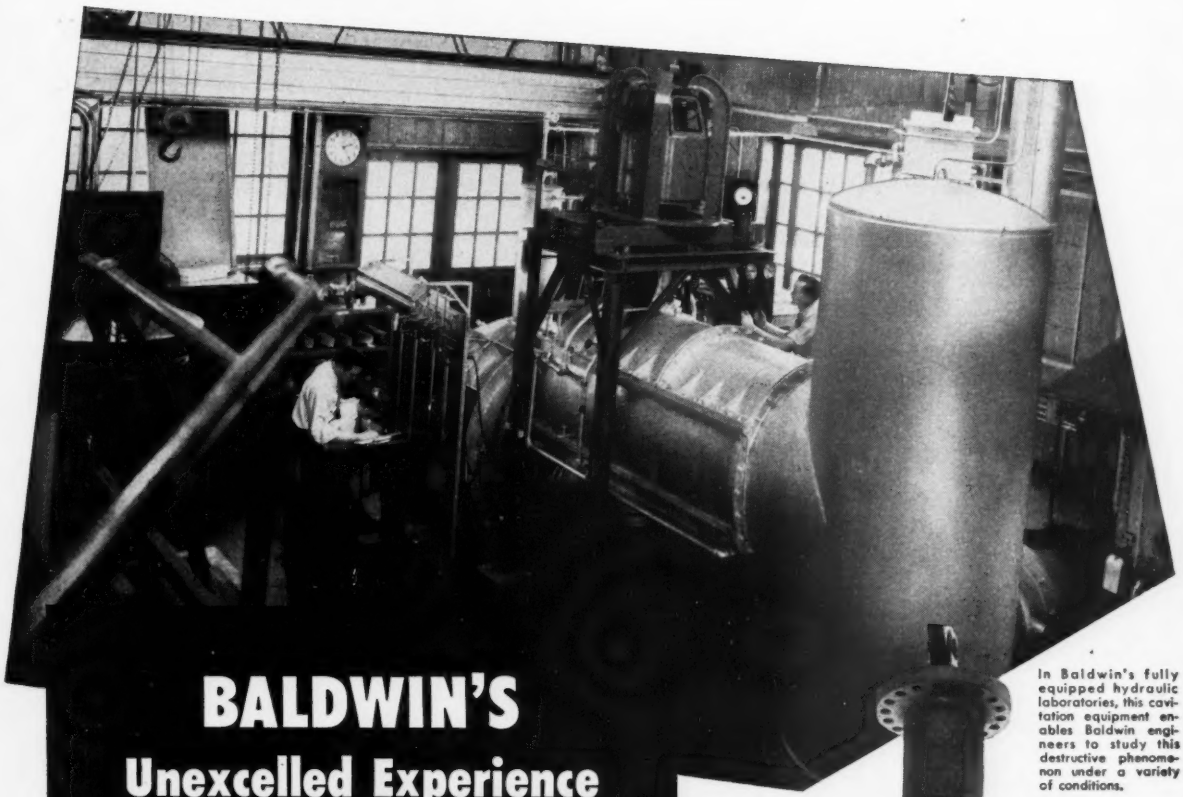
INTERLOCKING TERMINAL BLOCKS

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

A-B Quality

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

8-53-MR



In Baldwin's fully equipped hydraulic laboratories, this cavitation equipment enables Baldwin engineers to study this destructive phenomenon under a variety of conditions.

BALDWIN'S
Unexcelled Experience and Research Pay Off Again With 94% Efficiency of Center Hill Turbines

Here is the one-piece, 127,200 lb., 186⅛ in. runner for the Baldwin 62,500 hp Francis-type turbine at Center Hill and Wolf Creek Dams.

Baldwin's continuing research, combined with experience in designing and building all types of turbines from as early as 1825, is paying a big dividend to the Corps of Engineers at its Center Hill and Wolf Creek Dams.

Initial tests of one of three 62,500 hp vertical Francis-type turbines at Center Hill showed a maximum attained efficiency (at 105.9 rpm and 160 foot head) of 94% . . . one of the best efficiency records ever obtained for Francis-type units. Since the six Baldwin-built turbines for Wolf Creek are identical, the Corps of Engineers has the benefit of similar high efficiency for its two Cumberland River Valley hydro-electric plants which will generate about 1218 million kwhr each year.

Whatever your hydro-electric project, Baldwin engineers will be glad to put their vast experience and resources at your service to help you get top performance. Experienced with all four basic type of turbines . . . Francis, Kaplan, Pelton Impulse and Propeller . . . they can give you an unbiased opinion of the type best suited to your flow and head conditions.

For details about Baldwin research and some interesting turbine installations, please write for Bulletin 1000 to Department 5107, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

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BALDWIN-LIMA-HAMILTON

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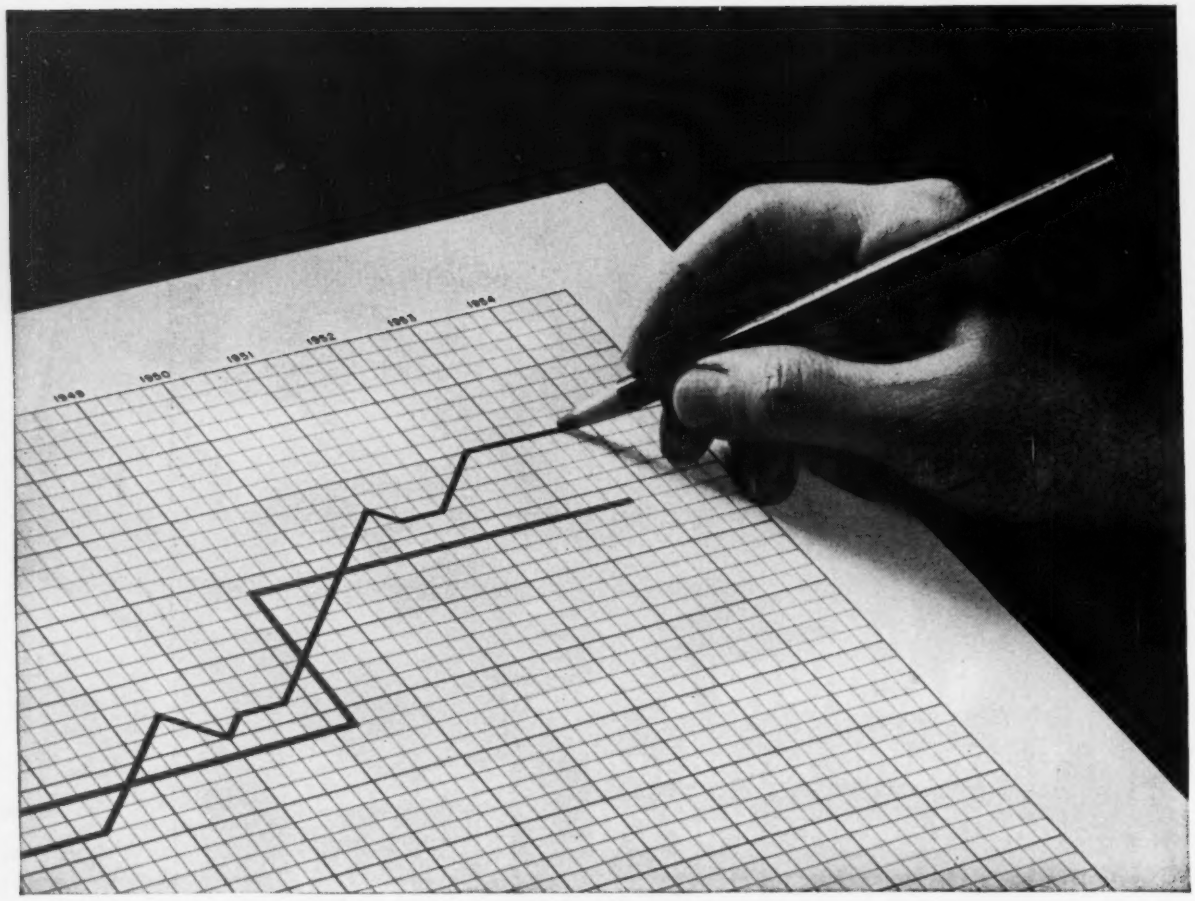

Caution: dangerous curves

Keeping your fire protection properly balanced with changes in processes as well as ups and downs in production is vital to efficient, profitable operation.

You'll find your best answer to this serious fire problem which is currently confronting industry by installing an expansible, fully approved C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing System. Simple piping, running from one centrally located storage tank, instantly transports clean, non-damaging, non-conducting carbon dioxide anywhere in the plant area. Fire at any protected location is extinguished in seconds with an absolute minimum of expense and interruption.

Changes in your fire protection requirements are easily and economically provided for with a C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing System by initially installing an oversized storage tank and adding where necessary the supplementary discharge facilities at a later date.

Flexibility is the keynote . . . the low pressure carbon dioxide storage tanks range in capacity from one to fifty tons . . . discharge facilities can be either manual mechanical, manual electric, automatic mechanical, automatic electric or a combination of these . . . especially installed to fit your particular needs.

WHEN BUSINESS STOPS . . . INCOME STOPS!

Don't take chances with your investment. Secure the benefits of highly efficient fire protection engineering today... our extensive experience over the years is at your disposal without obligation. Get the facts now!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY

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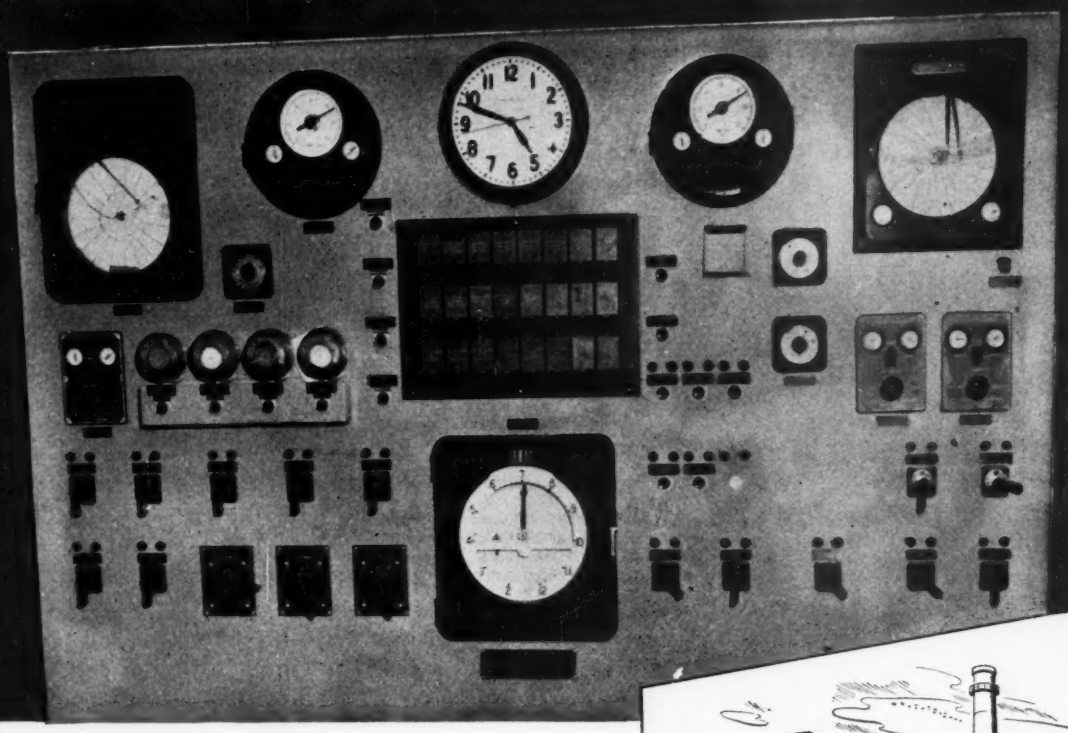
Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY



Atlantic City Electric Company selects PERMUTIT WATER CONDITIONING with *centralized, automatic control*

Greenwich Station. Normal steam capacity: 460,000 lb per hr. Engineered and constructed by Burns and Roe, Inc., New York City.

To FILL *changing* demand for 100% makeup with highest purity feedwater requires the best of equipment and a degree of efficiency obtainable only with modern automatic control.

At the Greenwich Station, instrumentation — centralized in Permutit cubicles — provides this control. The water-treatment plant supplies makeup that meets requirements for two 650 psig boilers operating under *wide ranges* in load . . . for steam output and turbo-generator exhaust must also fill the changing process-steam needs of a very large, nearby chemical plant.

TREATMENT METHODS SPECIFIED

Consulting engineers investigated several plans to determine the most efficient and economical means of making Delaware River water satisfactory for two 230,000 lb per hr boilers. Final decision was to treat the water with *Permutit equipment:* coagulation, silica reduction, filtration, hydrogen-sodium-zeolite softening, degasification . . . with provision for demineralization if required.

REQUIREMENTS FOR COMPLETE CONTROL

Mounted on the Permutit central control board are flow controllers and loss of head gauges for each filter; flow recorders, level indicators, alarms, timing devices, etc. A pH indicator assures proper blending of the sodium and hydrogen-zeolite softened waters. After setting flow rates, timing elements, etc., this entire Permutit water-treatment system operates *automatically!*

Find out how Permutit can solve your water problems. Write to THE PERMUTIT COMPANY, Dpt. EW11, 330 West 42nd Street, New York 36, N. Y. or Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

PERMUTIT®

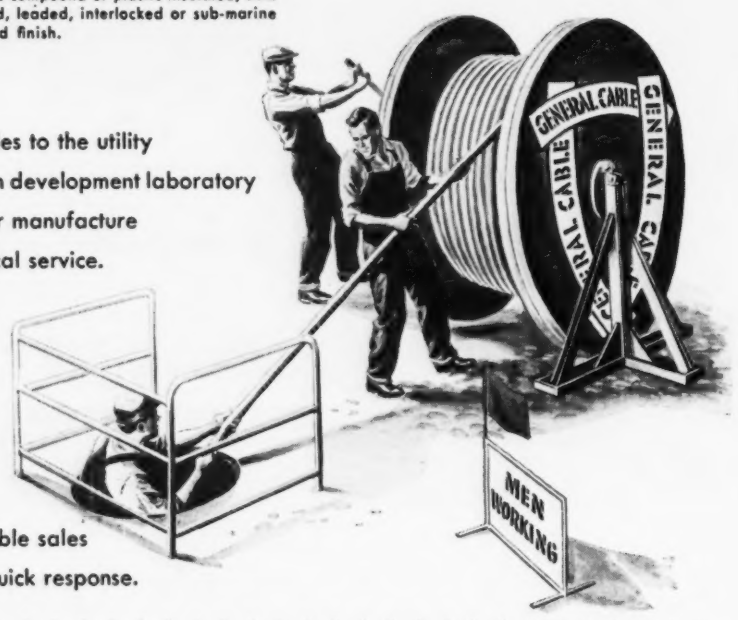
ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS

For all system requirements

☑ CHECK General Cable FIRST FOR RUBBER AND PLASTIC POWER AND CONTROL CABLE

For duct and conduit installation, for direct earth burial and sub-marine use as well as for aerial application including self-supporting types.

Rubber or GENCORONE (corona resistant) oil base compound or plastic insulated, with braided, leaded, interlocked or sub-marine armored finish.



As a principal supplier of power cables to the utility industry, General Cable maintains a modern development laboratory and streamlined, country-wide facilities for manufacture and distribution of types for every electrical service. Backed by 70 years of close liaison with every phase of utility operation, this experience enables General Cable to plan with you in the solution of any cable problem—generation, control, transmission and distribution.

A call or letter to the nearest General Cable sales office or to headquarters will bring you quick response.

Other principal products made for Utilities include:

Supersheath "Triplets"

- **Type USE**—THERMAX W insulation with NEOPRENE jacket for direct earth burial service entrance.
- **Type RHWN**—THERMAX W insulation with NEOPRENE jacket for aerial, duct, conduit and direct earth burial applications.
- **Type GN**—GENCORONE (corona resistant) insulation with NEOPRENE jacket for medium and high voltage applications—all types.

Bare Wires—Regular and TENSILOK copper, all aluminum and A.C.S.R. conductors.

Weatherproof Wires—OK, PEERLESS textile covered TIP-TOP neoprene covered, polyethylene covered; with regular or TENSILOK copper, copperweld, aluminum, or A.C.S.R. conductors.

Service Drop Cables—Copper or aluminum conductor—ENTERITE, type SD, PEERLESS and aerial messenger types.

Service Entrance—SUPERSHEATH type USE, SE style U, SE style A.

Series and Multiple Street Lighting Cables—buried, duct, or aerial (mast arm or arc drop) rubber, GENCORONE, polyethylene or plastic insulated with braided, leaded or plastic jacket.

Paper Power Cables—Solid, low pressure gas, and oil-filled, with leaded, neoprene over lead and armored finish. Pipe types (high and low pressure) oil and gas filled.

Asbestos-VC, and all asbestos station and control cables.

Varnished Cambric—power, control, apparatus and station cable, with braided, leaded, and interlocked armored finish.

GUARDIAN Rubber and Plastic Building Wires.

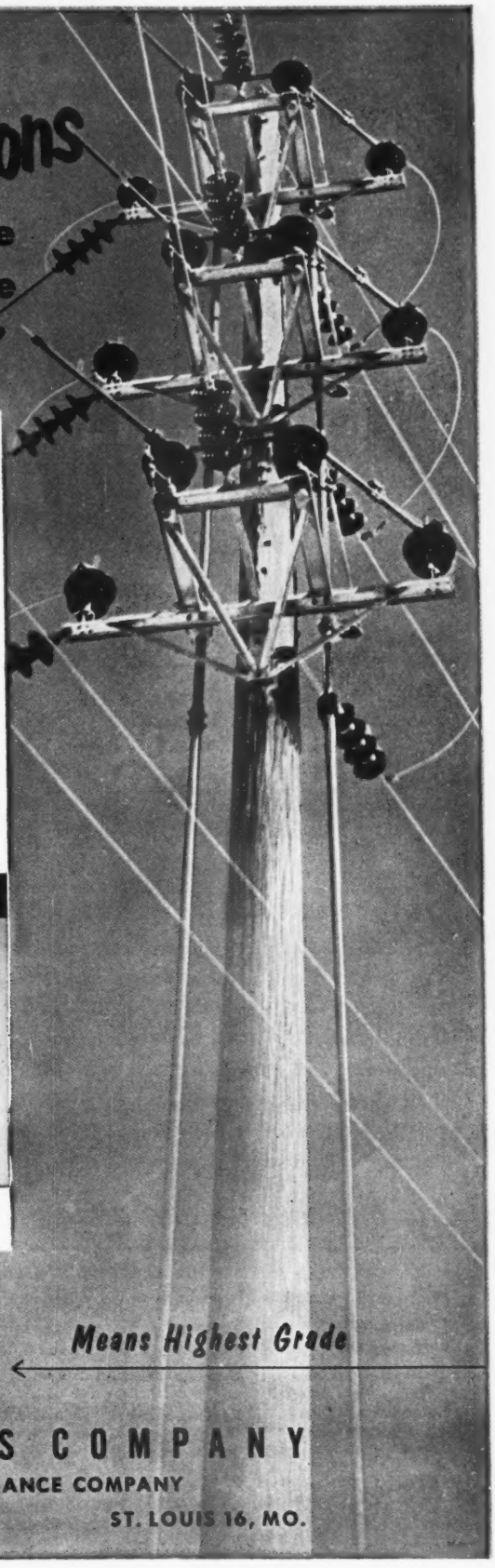
Tree Wire . . . and other types.

GENERAL CABLE
CORPORATION

Executive Offices: 420 Lexington Avenue, New York 17, N.Y. • Sales Offices in Principal Cities of the United States

4 money saving reasons

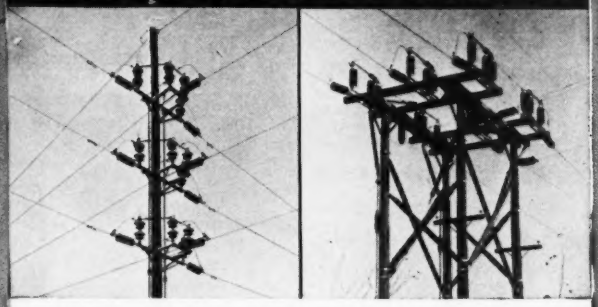
why Matthews GOABS* have gained nationwide acceptance *in only three years!*



- **Reduces structure costs . . .** mounts on single pole eliminating need for multi-pole structures.
- **Saves valuable, hard-to-get line crew time . . .** mounting of switch is simple, requires less hardware.
- **Requires minimum right-of-way . . .** no expensive additional right-of-way.
- **Safe and easy maintenance . . .** linemen like 180° free climbing space . . . particularly advantageous for hot line jobs.

*Gang Operated Air Break Switch

COMPARE THE COSTS OF THESE INSTALLATIONS



Bulletin 601-A contains complete information on the Matthews GOABS. Send for your copy today.

This Mark in Trade... MATTHEWS *Means Highest Grade*

W. N. MATTHEWS COMPANY

DIVISION OF THE A. B. CHANCE COMPANY

3850 DELOR STREET • ST. LOUIS 16, MO.

5 Ways to Speed Up Your Service Work

Series 44-90 can be installed on chassis having C.A. dimension of approximately 48″

Series 44-75 for chassis having approximately 40″ C.A. dimension.

Series 44-104 for single or dual rear wheel chassis having 60″ C.A. dimension.

Series 44-L-90 for chassis having approximately 48″ C.A. dimension.

Series 44-L-104 for 60″ C.A. chassis having single or dual rear wheels.

POWERS American (A·B)

SERIES 44 and 44-L

SERVICE AND MAINTENANCE BODIES

These five bodies have an impressive record for saving time and money on service jobs. Compartments are equipped to keep tools and supplies safe and orderly — easy to inventory before leaving for the job — easy to find upon arrival. The bodies are adaptable to a wide variety of service operations, and each model can be transferred to a new chassis when the original truck wears out. If you're looking for new ways to get more productive man hours, you'll want full information on Series 44 and 44-L bodies. Why not send for complete details . . . now?

Clip this coupon and attach to your letterhead!

McCABE-POWERS AUTO BODY CO., 5900 N. Broadway, St. Louis 15, Mo.
Please send me complete information on the following:

- ☐ Series 44-75
- ☐ Series 44-90
- ☐ Series 44-104
- ☐ Series 44-L-90
- ☐ Series 44-L-104
- ☐ Line Construction Bodies
- ☐ Revolving Aerial Ladders
- ☐ Hydraulic Towers
- ☐ .....

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

ST

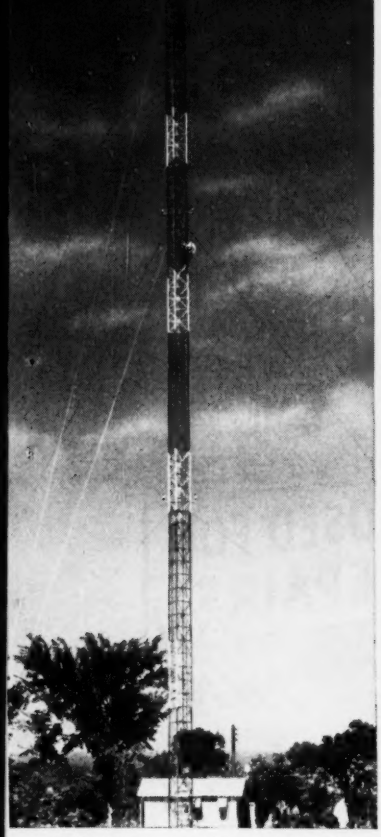
POWERS American (A·B) DIVISION

PUBLIC UTILITY BODIES & EQUIPMENT

McCABE-POWERS AUTO BODY CO.

MAIN OFFICE AND PLANT
5900 N. Broadway • St. Louis 15, Mo.

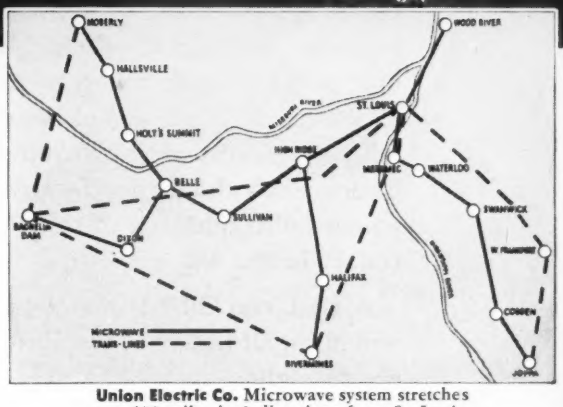
WESTERN OFFICE
Latham Sq. Bldg. • Oakland 12, Calif.



RCA Microwave radio relay installation at High Ridge, Mo. Towers are rugged, designed to withstand 100-mph winds under severe icing conditions.

Osage Hydroelectric Power Plant installation of Union Electric Company of Missouri, at Bagnell Dam, Mo.—serviced by RCA Microwave.

How UNION ELECTRIC solved today's communication problem



Union Electric Co. Microwave system stretches out 425 miles in 3 directions from St. Louis.

Two years ago Union Electric Company of Missouri ran into the communication problem which sooner or later confronts all growing utilities: their high-line carrier transmission system had become inadequate.

The 150 kc bandwidth, allotted for power line carrier operation, permits the use of only a relatively few channels which are not sufficient to meet all the requirements of a modern communications system. Direct wire lines were ruled out as too costly.

That prompted engineers to adopt Microwave, supplemented with mobile radio at major relay points. RCA Microwave provides channels for remote control of load dispatching, telemetering, teletype and voice communication. It results in close co-ordination of vehicles, field crews, executive and service personnel at outlying offices and stations. And, 70% of the RCA Microwave system is available for future expansion.

RCA Microwave can be interconnected with existing phone lines and switchboards. It uses familiar channeling circuits and readily available tubes. It provides as many channels as needed with minimum use of frequency space.

Now Union Electric has dependable, year-round communications over the full length of its operations. RCA "dish" antennas atop 100- to 300-foot towers, spaced 11 to 46 miles apart, send concentrated beams of radio energy from station to station. The radio beams follow a line-of-sight path—approximately parallel to the transmission lines.

You, too, can plan now for tomorrow's problems—prepare for your expanding communications needs before they develop. The booklet listed below provides quickly digested facts for future thinking, *with no obligation on your part.* Mail the coupon. *Remember,* only RCA can provide the nation-wide service facilities of the RCA Service Company.

RADIO CORPORATION of AMERICA
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.

Dept. 45W, Building 15-1

Please send me your reprint describing Union Electric Microwave system, *"Microwave Relieves Overloaded Circuits."*

Name_____ Title_____

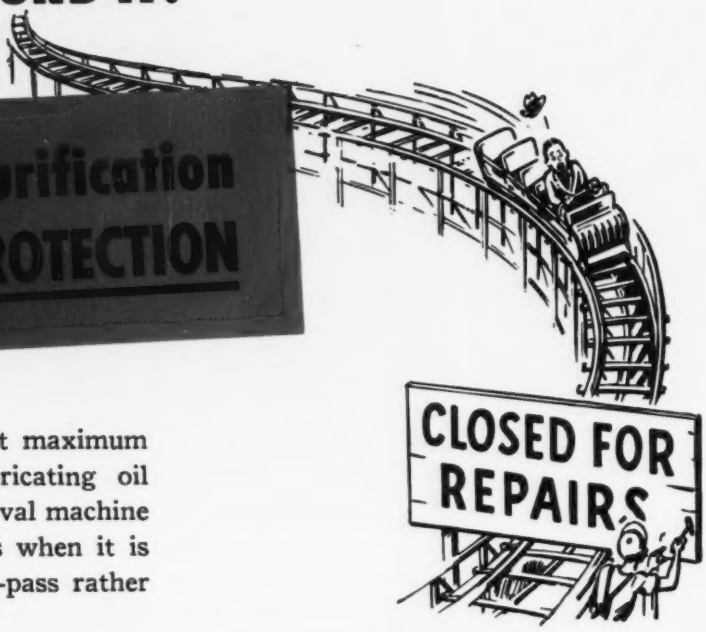
Company_____ Address_____

City_____ Zone_____ State_____

☐ Have an RCA representative get in touch with me.

NO GETTING AROUND IT!

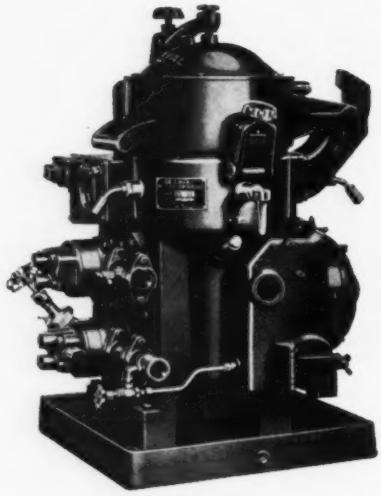
CONTINUOUS Purification Is Continuous PROTECTION



To give your power unit maximum protection, purify the lubricating oil ***continuously.*** Even a De Laval machine gives most effective results when it is operated on continuous by-pass rather than on "batch."

This is so because the action of the centrifuge is itself continuous — the machine constantly discharges clean dry oil and sends the removed water to waste. Any leakage of water to the lubrication system shows up at once. There is no chance for any dangerous amount of condensate or other water to collect in the oil.

A De Laval Oil Purifier of proper size will clean all the oil in the system every six to eight hours. The exact rate of purification depends on the viscosity of the oil and the size and character of the contaminants. No getting around it, continuous purification provides continuous ***protection.***



THE DE LAVAL SEPARATOR COMPANY • Chicago POUGHKEEPSIE, N.Y. San Francisco

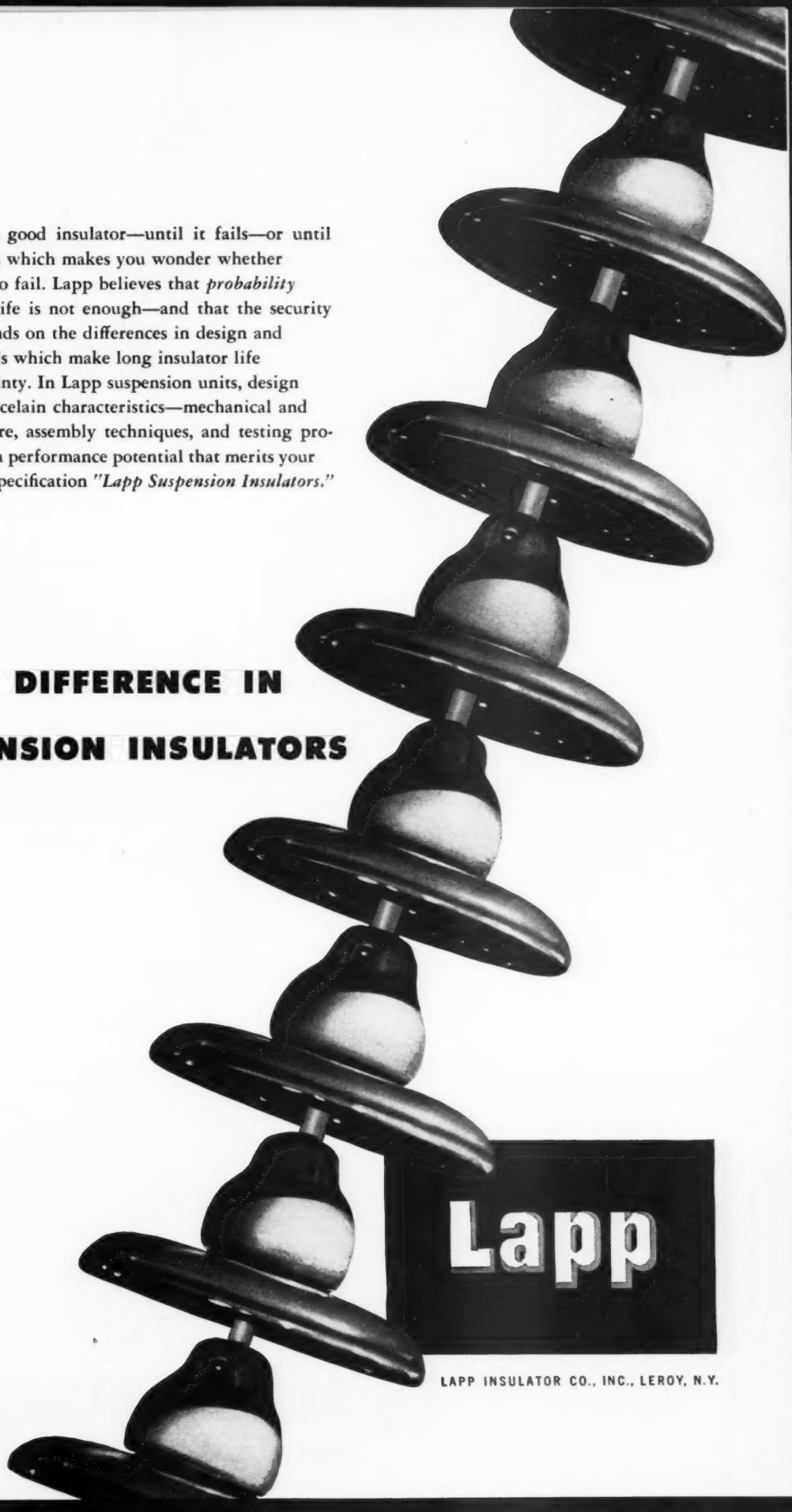
DE LAVAL

OIL PURIFIERS

FOR MORE DEPENDABLE POWER PRODUCTION

Any insulator is a good insulator—until it fails—or until something happens which makes you wonder whether or not it is going to fail. Lapp believes that *probability* of long insulator life is not enough—and that the security of your lines depends on the differences in design and production methods which make long insulator life a predictable certainty. In Lapp suspension units, design considerations, porcelain characteristics—mechanical and electrical—hardware, assembly techniques, and testing procedures, add up to a performance potential that merits your confidence in the specification *"Lapp Suspension Insulators."*

THERE IS A DIFFERENCE IN SUSPENSION INSULATORS



Lapp

LAPP INSULATOR CO., INC., LEROY, N.Y.

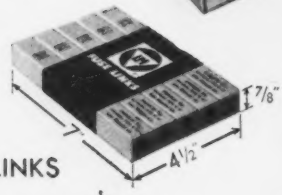
L-M's Outstanding Packaging System for EEI-NEMA Fuse Links

Provides sturdy protection for the links and convenience in warehousing, distribution, and handling.

1. (Left) **Tear Off Cell:** The perforated tape makes it easy to remove one link at a time from the 5-cell carton, without exposing other links.

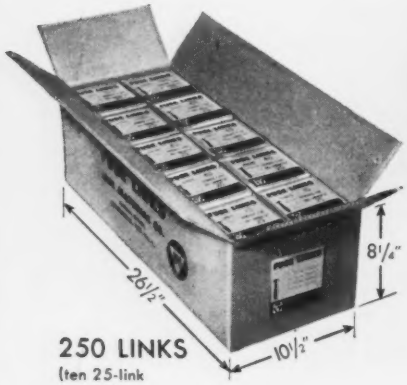
2. (Below) **Break Open:** The end of the cell is perforated. The link comes out of the cell in the lineman's hand. The complete job, from carton to cutout, can be done with gloved hands.

L-M's EEI-NEMA Fuse Links Conveniently Packaged



5 LINKS

25 LINKS
(five 5-cell cartons)



250 LINKS
(ten 25-link cartons)

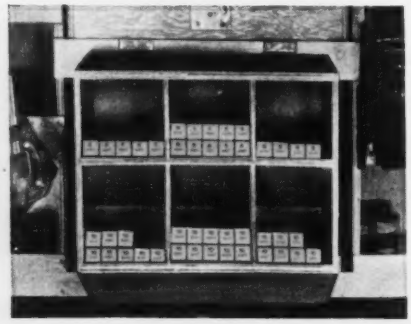
Every cell, carton, and case is clearly marked with rating, and EEI-NEMA-Standard type (K or T). Rating and type are also clearly stamped on top of link button.

L-M provides an outstanding packaging system for its new EEI-NEMA-Standard and "N" rated fuse links.

Links are in individual 5-cell perforated containers (3-cell for links above 100 amperes). One cell at a time can be torn off and the link used without exposing other links.

Five of these 5-cell containers come in a 25-link carton. These, in turn, are packed 10 to a large 250-link case. All cases, cartons and cells are individually labeled, in large type, with quantity, rating, and link *type*.

This system provides for convenient shipping, storage, and distribution—in the warehouse and on the truck. Large cartons can be stored in the main warehouse. Branch warehouses can be supplied with the 25-link cartons. Five-cell containers can be carried in racks on the truck.



Convenient for storage in racks in line trucks. Ampere ratings shown in large type on both ends of cartons.

Free Handy Fuse Link Curve Sheet Packet and Bulletin on New EEI-NEMA Links

Ask the L-M Field Engineer for a copy of Bulletin FC5A, with full information on ratings and coordination of L-M's new EEI-NEMA-Standard fuse links. If you'd like it, he'll give you one of L-M's handy fuse link curve sheet packets with curves on EEI-NEMA and L-M Hi-Surge links. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LINE MATERIAL
fuse cutouts and fuse links

Compare the Things That Count

L-M's New Large Round-Wound Transformers Are 20% Lighter... Exciting Current Is 70% Lower

New 167 kva • 250 kva • 333 kva • 500 kva

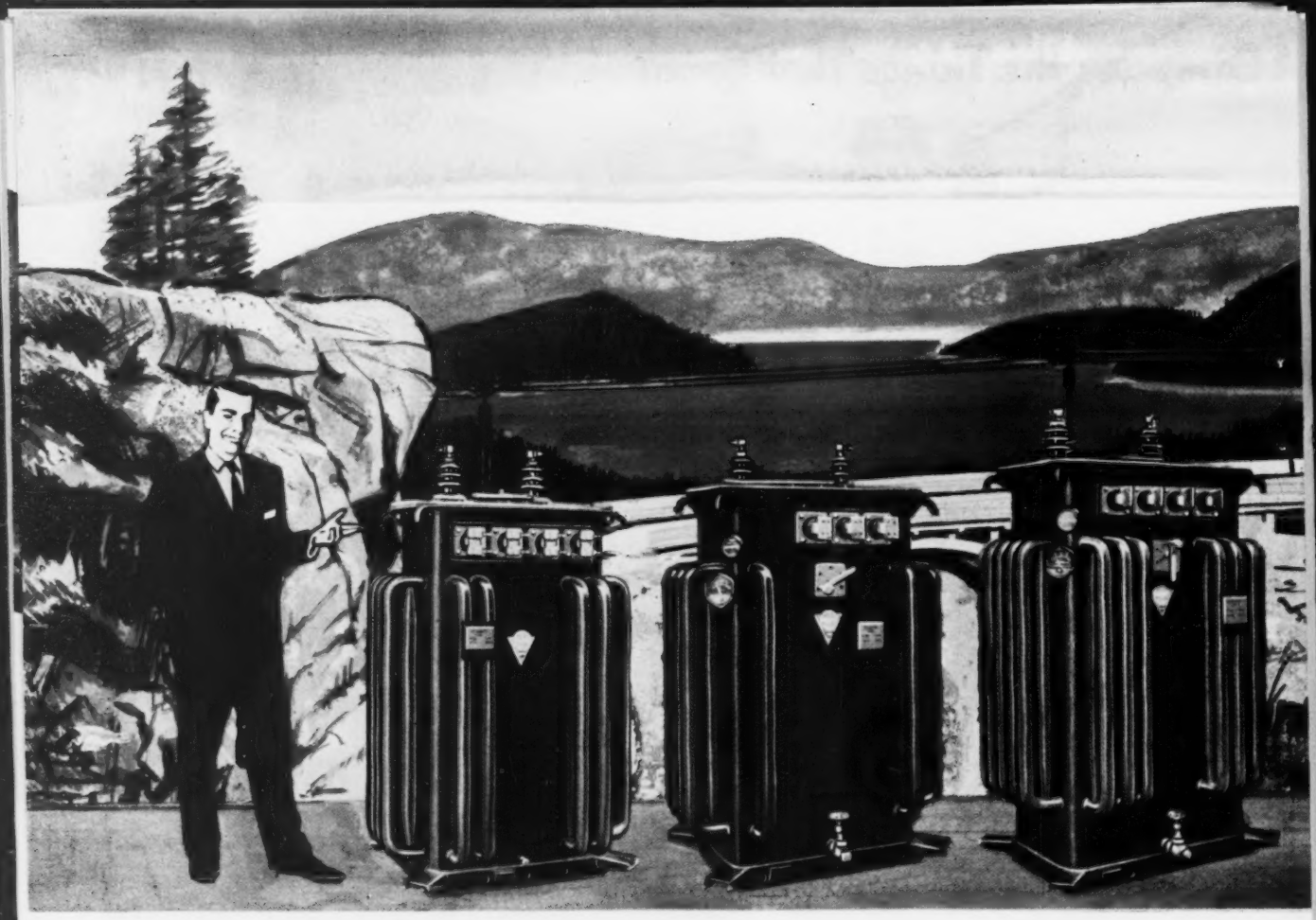
New Fifth Report Standard 167 to 500 kva Round-Wound transformers offer uniformly high impulse strength and high short-circuit strength, improved regulation, lower overall losses, low exciting current, excellent overload capacity.

L-M's new 167 kva Round-Wound transformer is lighter for easier and safer pole mounting.

LINE MATERIAL

Transformers

LM®



The four new large Round-Wounds. Left to right, 167 kva, 250 kva, 333 kva, and 500 kva. Units are available in all standard voltage ratings through 14400 volts. The table gives the dimensions and weights of units rated 7200/12470Y to 120/240 volts on the 167 kva size and 240/120 volts in larger ratings.

KVA	Overall Height	Overall Width	Overall Depth	Total Net Weight lbs.
167	66⅞"	40⅞"	25⅞"	2100
250	69⅞"	44"	32"	2850
333	73⅞"	46"	38⅛"	3650
500	79"	54"	43"	4650

L-M's New Large KVA Round-Wound Transformers Are 20% Lighter; Exciting Current Is 70% Lower

By **ALVIN B. COYLE,**
Manager,
Transformer Sales
Line Material Company

To meet the new standards recommended by the EEI-NEMA committee's Fifth Report, a number of design changes have been made in L-M's 167 to 500 kva transformers.

Along with these changes, we have completely redesigned the line in all voltage classes to take full advantage of the inherent qualities of the Round-Wound style of design, an L-M exclusive.

20% Lighter

The result is a line of transformers that offers many distinct advantages to our customers. For example, our new designs average 20% less weight than our old designs.

Cores are of oriented grain cold-rolled silicon steel strip. Taking full advantage of this steel by the Round-Wound design is an important factor in this weight reduction.

Exciting Current 70% Lower

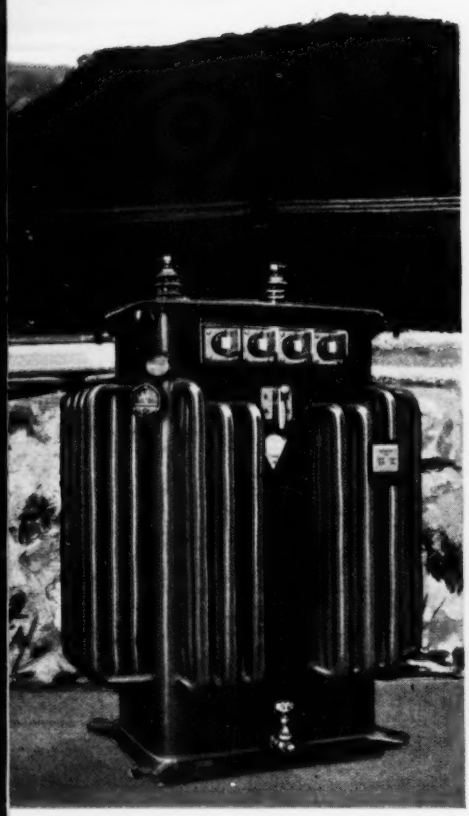
Exciting current has been reduced 70%, a drastic reduction that obviously offers a desirable saving. Other losses have also been reduced. On the average, total losses are down about 3% from those of our older designs, which is a further reduction in losses that were already remarkably low. This reduction in losses has been accomplished coincidentally with reduced size, lower exciting current, and other improvements.

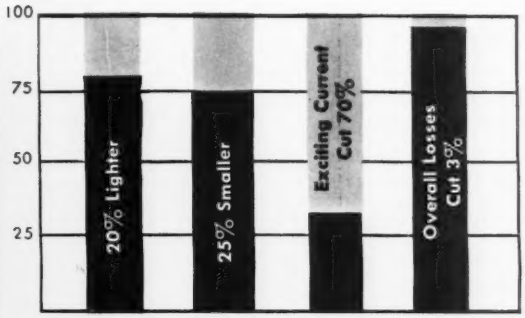
Excellent Regulation

A low value for regulation dictates a low impedance. Conversely, a high impedance contributes to improved short-circuit strength.

The new large kva Round-Wounds are designed to give the best regulation compatible with the other desirable performance characteristics. This is an example of L-M's "Balanced Performance" design.

Compare the Things That Count





Bars show average improvements in new Fifth Report designs over our own previous 167 to 500 kva transformers.

20% Lighter: weight has been reduced on the average of 20%. The 167 kva can now be pole-mounted more safely and easily.

Sizes Reduced Up To 25%: with the new design, size has also been reduced.

Exciting Current Cut 70%, with the new design.

Overall Losses Cut 3%: losses that were already low have been further reduced.

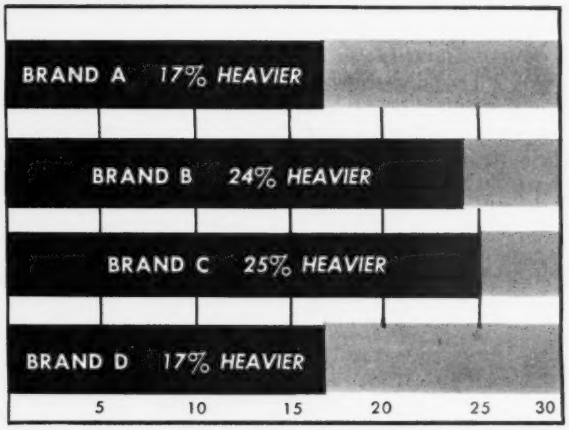


Chart shows how much heavier four other well-known makes of transformers are than the new L-M. Figures are based on the 500 kva, 7200/12470Y—240/120 volts. This is typical of weight comparisons on other ratings and voltage classes.

Uniformly High Impulse Strength

The excellent field record of the smaller sizes of Round-Wound transformers under all service conditions is a tribute to the basic principles of this efficient L-M style of construction. Uniformly high impulse strength and excellent overload capacity are fundamental to the Round-Wound transformer. The new large kva units have been designed to take full advantage of these very important characteristics.

Smaller Sizes

The new Round-Wounds in larger sizes are designed to give the most quality in the smallest and lightest package. The things that count have been given unlimited consideration in design and manufacture.

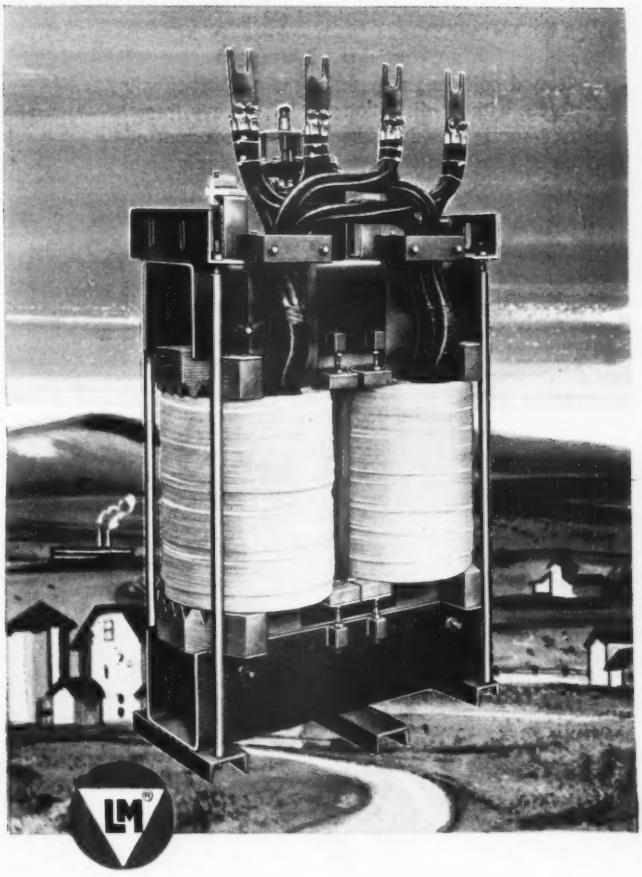
Let Us Tell You The Whole Story

Ask the L-M Field Engineer for descriptive literature and specifications of the new L-M Round-Wound transformers. Or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

Core-Coil Assembly

Core and coil assembly of the new 500 kva Round Wound. Note the compact, strong construction; the ample surface exposed to cooling oil; the strong frame and heavy blocking for high short-circuit strength.

"Round-Wound" is a Line Material Company trademark



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LINE MATERIAL Transformers

You Get Advantages Like These In L-M Round-Wound Transformers

Round-Wound construction consists of round coils, wound directly onto a wound core. The core is wound, then annealed. It is not cut, unwound or otherwise disturbed. L-M is the only manufacturer making a core this way. The result is a magnetic circuit with uniformly low excitation losses. Coils are wound directly onto the completed core by L-M's exclusive process. This construction offers many advantages.

Better Cooling—Higher Short-Time Overload Capacity

The long round coils present large, unobstructed surfaces to the cooling oil. In addition, the cruciform-cross-section core provides natural oil passages between coil and core for additional cooling. That is why, in the Round-Wound transformer, heat is dissipated more rapidly and more uniformly, providing higher overload capacity.

High Impulse Strength

The Round-Wound design has inherently strong insulation, and allows the designer to provide substantially longer creepage distances than is possible in other types of construction. Therefore, the Round-Wound design has uniformly high impulse strength, which is borne out by extensive laboratory tests and field service experience.

High Short-Circuit Strength

Round coils naturally resist radial short-circuit forces without distortion; and the heavy frame and strong blocking prevent axial movement of coils. Thus Round-Wounds have extremely high short-circuit strength.

"Balanced Performance"

Physical and performance characteristics are well balanced in the Round-Wound transformer. No one characteristic has been emphasized at the expense of another.

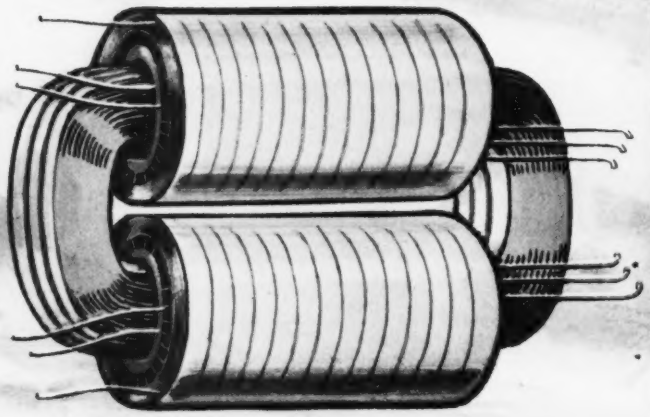
Get Complete Information

Ask the L-M Field Engineer for complete information on the construction and characteristics of L-M Round-Wound transformers; or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

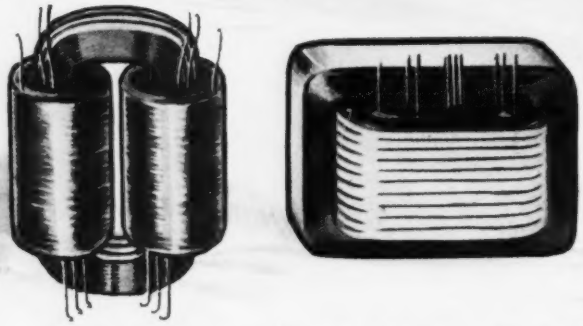
"Round-Wound" is a Line Material Company trademark

LINE MATERIAL

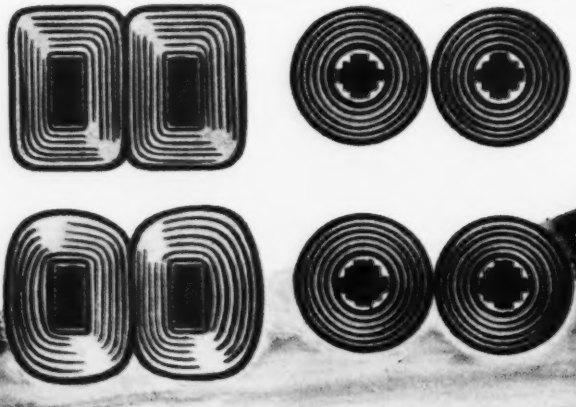
Transformers



Round coils are wound directly onto the completed core. The core is not disturbed, cut or disassembled after annealing. Coils surround a maximum of the magnetic circuit. They present a relatively large area to cooling oil.



Round-Wounds have high impulse strength, because they provide better insulation and longer creepage paths, as seen by comparing typical Round-Wound with typical shell-type construction.



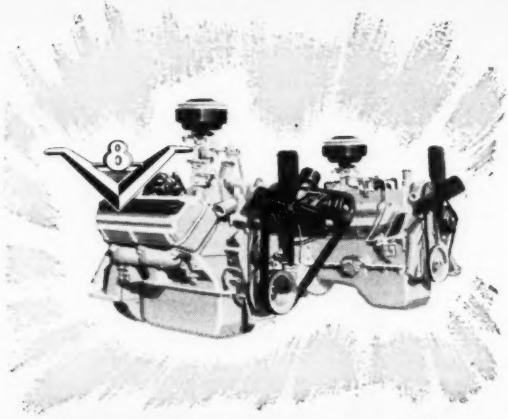
Short-circuit strength is high. Round coils suffer no radial distortion, as compared with coils of rectangular cross section. Heavy steel frame, strong blocking, and varnish of extremely high bonding strength contribute to prevent axial movement under short-circuit stresses.

★ ANNOUNCING NEW ★

DODGE "Job-Rated" TRUCKS

Brilliant new design opens new era in trucking!

★ **Compare their new comfort!** ★ **Test their new handling ease!**
★ **See their new low work-saving design!**

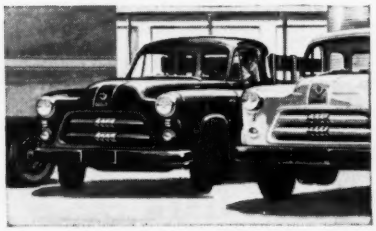


2 GREAT ENGINE LINE-UPS! In addition to cost-cutting 6's, Dodge now offers the most powerful V-8 engines of all leading trucks! Available in 1½-, 2-, and 2½-ton models . . . standard in 2¾-, 3-, 3½-ton! Revolutionary hemispherical combustion chamber for high efficiency! Get free book on engine efficiency and its importance to you at your Dodge dealer's!

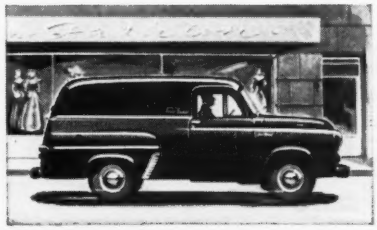
OVER 75 NEW FEATURES! Spectacular low-built lines! New increases in G.C.W.! New cab sealing against dust, drafts! Nonskid running boards!

PLUS famous Dodge features like . . . completely rustproofed sheet metal . . . moistureproof ignition! Truck-o-matic transmission with gyrol Fluid Drive, available!

New! Even greater values . . . yet still priced with the lowest!



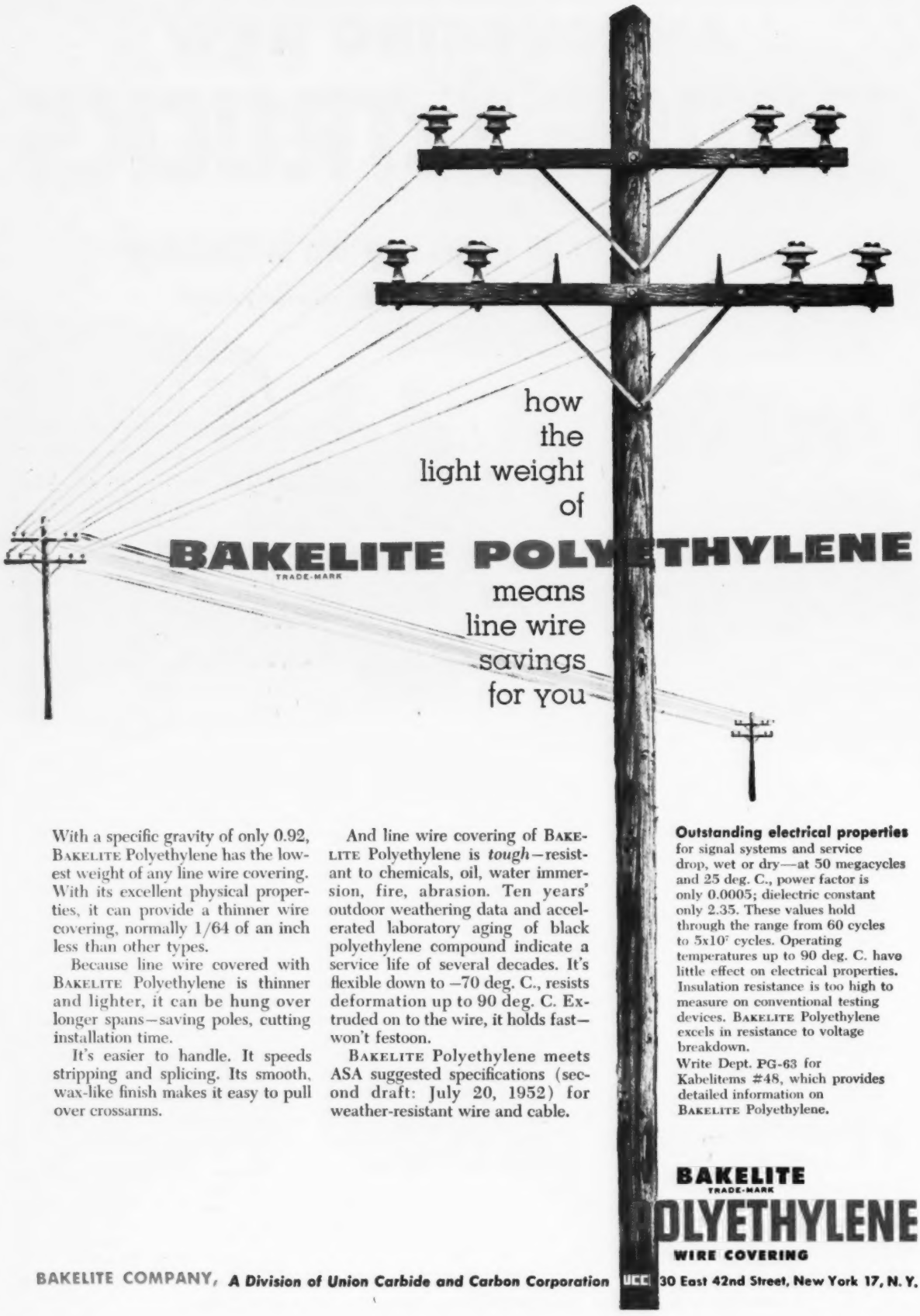
New! Sharper Turning! New steering system for the shortest turning of all leading trucks! New shorter conventional tractors! New, one-piece windshield! More total vision area than any other popular make!



New! Smarter Styling! New colors! New flow-line design, featuring integral fenders, sparkling chrome! New two-tone interior styling! New wider doors! New easy-chair seats! New instrument panel.

New! Lower Lines! Pick-up and panel floors knee-high for loading ease! Lower running board for easier entry! Lower hood for greater visibility! New, low center of gravity for road-hugging stability!

SEE YOUR FRIENDLY DODGE DEALER!



how
the
light weight
of

BAKELITE POLYETHYLENE
TRADE-MARK

means
line wire
savings
for you

With a specific gravity of only 0.92, BAKELITE Polyethylene has the lowest weight of any line wire covering. With its excellent physical properties, it can provide a thinner wire covering, normally 1/64 of an inch less than other types.

Because line wire covered with BAKELITE Polyethylene is thinner and lighter, it can be hung over longer spans—saving poles, cutting installation time.

It's easier to handle. It speeds stripping and splicing. Its smooth, wax-like finish makes it easy to pull over crossarms.

And line wire covering of BAKELITE Polyethylene is *tough*—resistant to chemicals, oil, water immersion, fire, abrasion. Ten years' outdoor weathering data and accelerated laboratory aging of black polyethylene compound indicate a service life of several decades. It's flexible down to –70 deg. C., resists deformation up to 90 deg. C. Extruded on to the wire, it holds fast—won't festoon.

BAKELITE Polyethylene meets ASA suggested specifications (second draft: July 20, 1952) for weather-resistant wire and cable.

Outstanding electrical properties for signal systems and service drop, wet or dry—at 50 megacycles and 25 deg. C., power factor is only 0.0005; dielectric constant only 2.35. These values hold through the range from 60 cycles to 5×10^7 cycles. Operating temperatures up to 90 deg. C. have little effect on electrical properties. Insulation resistance is too high to measure on conventional testing devices. BAKELITE Polyethylene excels in resistance to voltage breakdown.

Write Dept. PG-63 for Kabelitems #48, which provides detailed information on BAKELITE Polyethylene.

BAKELITE
TRADE-MARK
POLYETHYLENE
WIRE COVERING

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

THE WESTINGHOUSE POTENTIAL COIL DESIGN

gives you longer meter life

The potential coil is a vulnerable spot in any meter. Westinghouse has engineered four separate coil refinements that give extra-long meter life. Thousands of these coils have been in service for over a year with no breakdowns reported.

No moisture danger . . . Moisture in a coil can cause insulation failure; so to keep it out, we've capped the coil ends and impregnated the coil with a special polyester resin.

One less soldered joint . . . and that means one less cause of trouble. Leads are now fastened directly to coil windings—solidly anchored and embedded in the insulating material.

No air bubbles . . . Coils are *vacuum impregnated.* All air bubbles, a possible cause of failure, are removed before the insulation is applied.

No insulation voids . . . Some impregnating resins shrink upon solidifying, leaving voids which can cause dielectric breakdowns. The new resin, Laminac, hardens without shrinkage, without leaving voids.

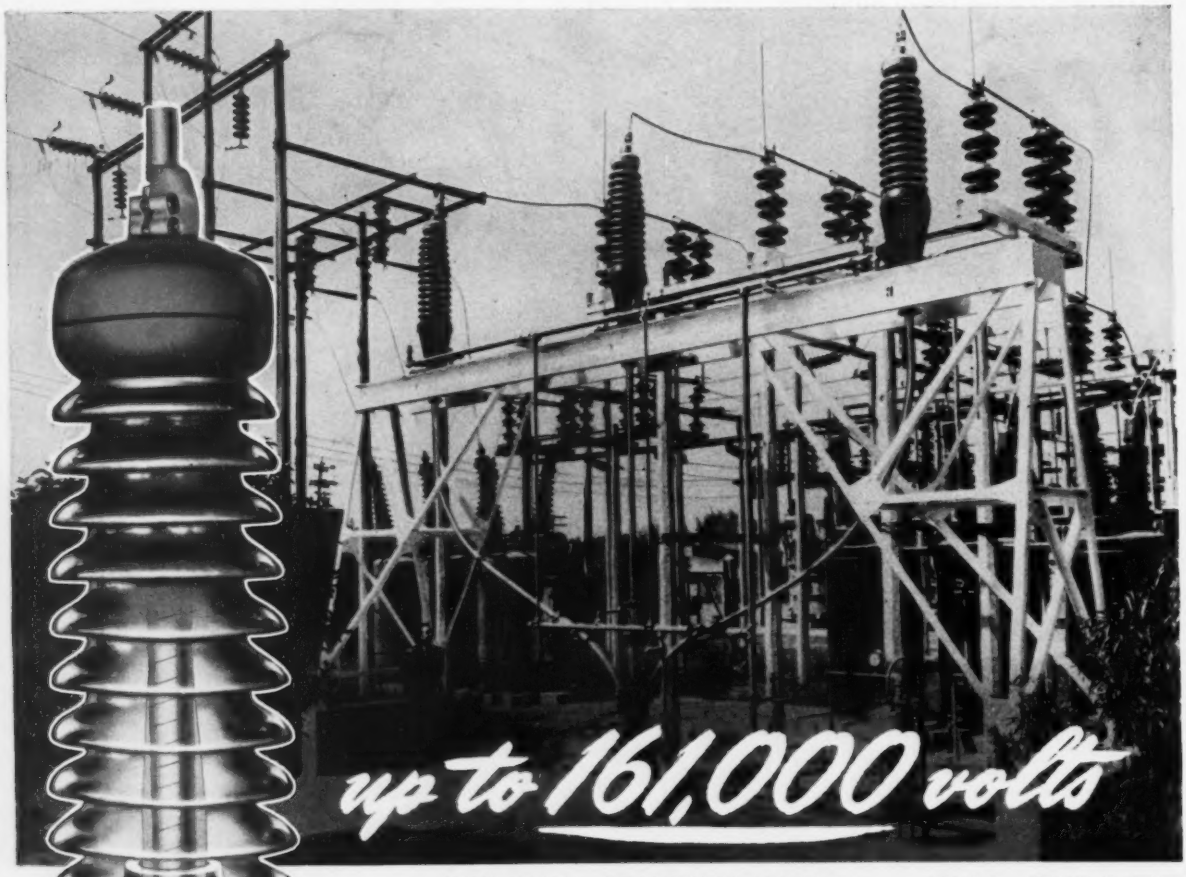
Get more information . . . This improved potential coil is one of several important refinements recently engineered into Westinghouse Meters. Write for, *What It Takes for Long-time, Low-cost Metering,* B-4665—an interesting, readable booklet. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

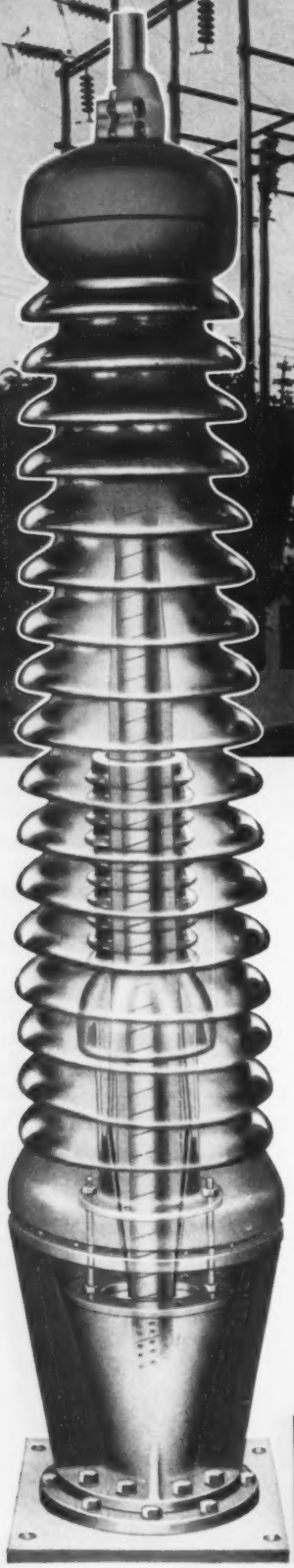
J-40443

Everything you need in meters and instruments

YOU CAN BE **SURE**...IF IT'S

Westinghouse





HIGH PRESSURE...OIL FILLED POTHEADS by G&W

Proper treatment of mechanical and electrical stresses permit this simple G & W design. Full 200 pound pipe line oil pressure is retained by the relatively small bore porcelain shell. Top and bottom fittings are fabricated, nonmagnetic, stainless steel—sealed by a minimum of gasketed joints.

Stress relief cone, supplemented by porcelain stress control tube, makes efficient use of the internal diameter and length of porcelain shell—and reduces the amount of installation labor.

Phantom view shows G & W type "ATA" 161 kv. pothead. Background installation shows G & W type "ATA" 115 kv. potheads.

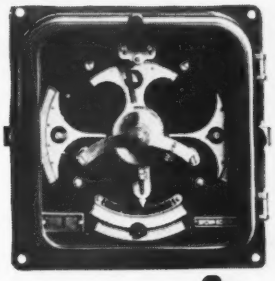
For further data, drawings and prices, send us a complete description of your cable.

G & W is now in a position to furnish Cable Joints, Oil Reservoirs, and accessories for oil and gas filled cables up to 161 Kv.

G & W ELECTRIC SPECIALTY CO.
7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.
Cable terminating, connecting and sectionalizing devices
Representatives in principal cities of U. S. A. In Canada – Powerlite Devices, Ltd., Toronto and Montreal

Now—the lowest priced top quality GENERATOR VOLTAGE REGULATOR on the market!

BROWN BOVERI



SINCE the day they were first introduced over thirty years ago, these Brown Boveri Voltage Regulators set new highs in performance and dependable service. Their record for trouble-free operation with an absolute minimum of maintenance is second-to-none.

Today, more than ever before, Brown Boveri Generator Voltage Regulators are REAL "buys". They are precision built for AC or DC service. They are completely self-contained. They are available in a variety of ranges from 1 to the highest kVA outputs. They are available for delivery in one month or less. AND . . . they are the LOWEST PRICED voltage regulators of their calibre on the market.

BROWN BOVERI

Get the facts. *Send for data today!*

BROWN BOVERI CORPORATION
19 RECTOR STREET, NEW YORK 6, N. Y.

At this very moment, hovering over your plant, fire is ready to swoop down on storage spaces, electrical generating equipment, record vaults.

But like a bird of prey, it casts a warning shadow... IF you have a KIDDE Industrial Smoke Detector.

Kidde

Walter Kidde & Company, Inc.
1130 Main Street, Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

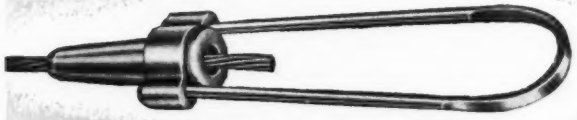
SPLICE or DEADEND STEEL STRAND
in seconds without tools

Reliable

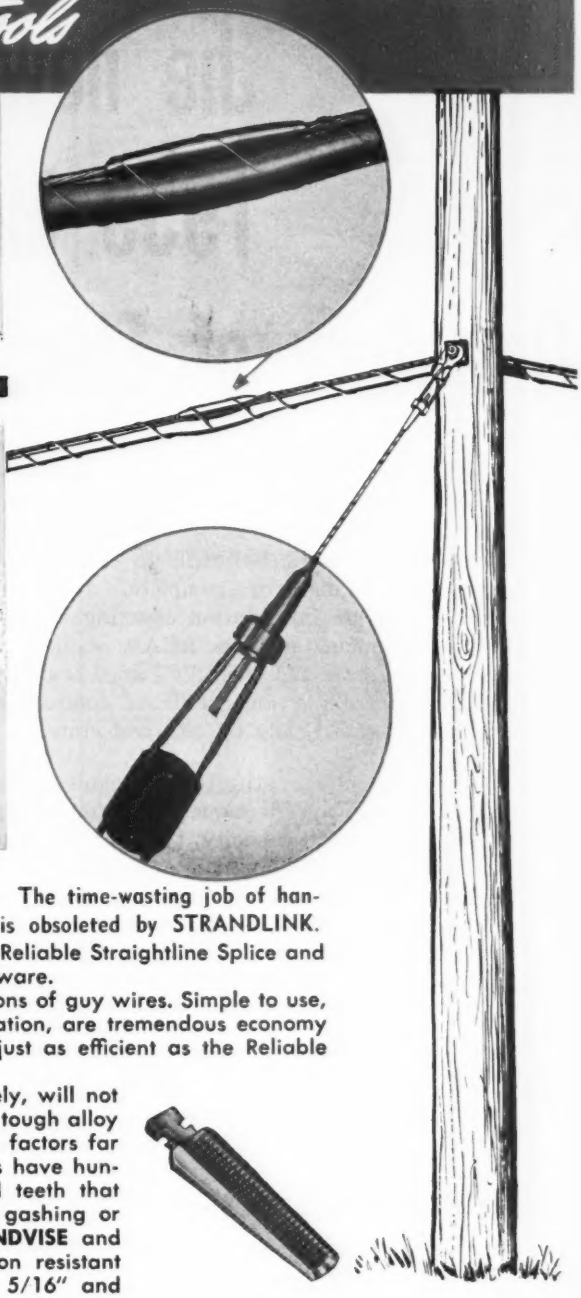
STRANDLINK

or

STRANDVISE



can cut installation time by 90%



STRANDLINK splices steel strand in seconds. The time-wasting job of handling nuts, bolts, hardware and johnny balls is obsoleted by STRANDLINK. STRANDLINK is used just like the well known Reliable Straightline Splice and costs far less than conventional splicing hardware.

STRANDVISE finds its greatest use in installations of guy wires. Simple to use, the time and wire saved, especially on relocation, are tremendous economy factors. STRANDVISE is just as easy to use, just as efficient as the Reliable Straight-thru Deadend.

Both **STRANDLINK and STRANDVISE** grip surely, will not slip. The cartridges of heat treated aluminum, tough alloy yokes, and stainless steel bails have strength factors far beyond that of the strand. The gripping jaws have hundreds of case-hardened, Zinolite-plated steel teeth that grip sharply, hold permanently yet without gashing or exposing bare steel of strand. Every **STRANDVISE** and **STRANDLINK** is factory treated with corrosion resistant lubricant for protection. Available in 3/8", 5/16" and 1/4" sizes.

Reliable

ELECTRIC COMPANY

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OVER 45 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS and CONSTRUCTION SPECIALTIES

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the new

1953 McGraw-Hill

Directory of Electric Utilities!

If you're looking for the vital statistics on more than 4,000 electric utility systems in the United States, its possessions and Canada, you'll find them in the 62nd edition of the McGraw-Hill Directory of Electric Utilities. Within its 800 pages, you'll discover complete, up-to-the-minute, *accurate* information covering all private and municipal utilities, REA's, public utility districts, state and federally-owned projects, holding, controlling and affiliated companies, arranged alphabetically by city and state.

More than a mere listing of companies, this directory offers you the names of the operating officials, generating capacity, types of generating equipment, transmission and distribution voltages, types of service, number of customers served, location of plants, and the towns served by each system. In short, if you need the who, what, where or whys of the electric power industry, here's the one place where you'll find all the answers.

You'll find the 1953 edition easier to use, too! While containing approximately 20% more names of individuals, each of the directory's pages has been completely restyled with larger, quicker-to-read type faces, assuring fast easy-on-the-eye reference. Beautifully bound in flexible blue Fabrikoid and fully thumb indexed, this latest edition of the McGraw-Hill Directory of Electric Utilities is now available at the low price of $30 per copy—with a ten percent discount on five or more copies.

Better send your order in today—more than half the supply has already been spoken for by companies with standing orders for each new edition. Just fill out and mail the convenient coupon—we'll gladly invoice you after shipment.

*State Directories Available Too!

For branch offices or companies interested only in limited areas, single state copies are available at minimum prices. However, these state directories can be sold only to those companies who order one or more copies of the complete directory. Write for prices and details.

McGraw-Hill Directory of Electric Utilities
330 West 42nd Street, New York 36, New York

Please rush me ..... copies of the 1953 Directory of Electric Utilities at $30 per copy (*ten percent discount on 5 or more copies*) and invoice me later.

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(Name) (Title)

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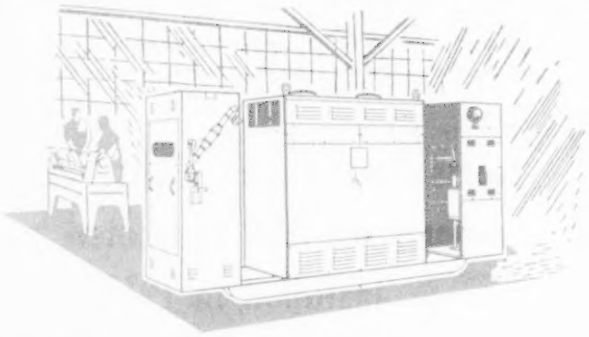
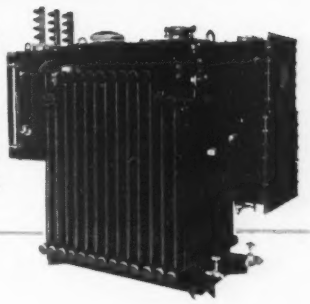
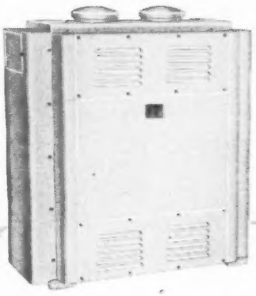
custom-built transformers



When custom design is a factor . . .

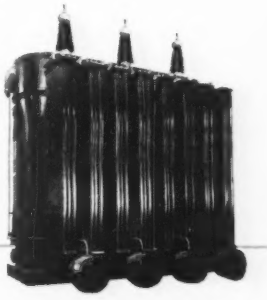
Askarel filled subway type network transformer, 500 KVA, 12480 to 216Y/125 volts, 3-phase, 60-cycle, complete with high voltage disconnect and grounding switch, low voltage network protector, and electrical interlocks.





Dry type air-cooled, load center transformer, 225 KVA, 3-phase, 60-cycle, 2400 to 120/208Y volts. Gang operated oil-fused cutouts are included with operating handle which is accessible through door in end of cabinet.

Power transformer, 10,000/12,500 KVA, 3-phase, 50-cycle, voltage 69,000Y to 13,200Y, with tertiary winding of 3500 KVA, air blast equipment for supplemental rating, low voltage terminal chamber and wheels.



TRANSFORMERS are the only product The Standard Transformer Company builds . . . the most important part of the load center. You thus have complete freedom in your choice of accessory equipment.

Specify the type and make of switchgear you prefer . . . STANDARD will quickly produce a complete, well-integrated unit, exactly designed to the proper dimensions and arranged according to your requirements.

As STANDARD has specialized in transformer design and application for more than 30 years, unusual assemblies are usual with us. You write your own ticket.

Whether unit installations are required for indoor, outdoor or underground, STANDARD will meet your most exacting requirements and include accessory equipment made by the supplier you prefer.

Write today for specific information.

Everything points to . .

WRITE FOR BULLETIN CL-50

See and read about actual transformer installation on the job around the world . . . evidence that your confidence in STANDARD is well placed.

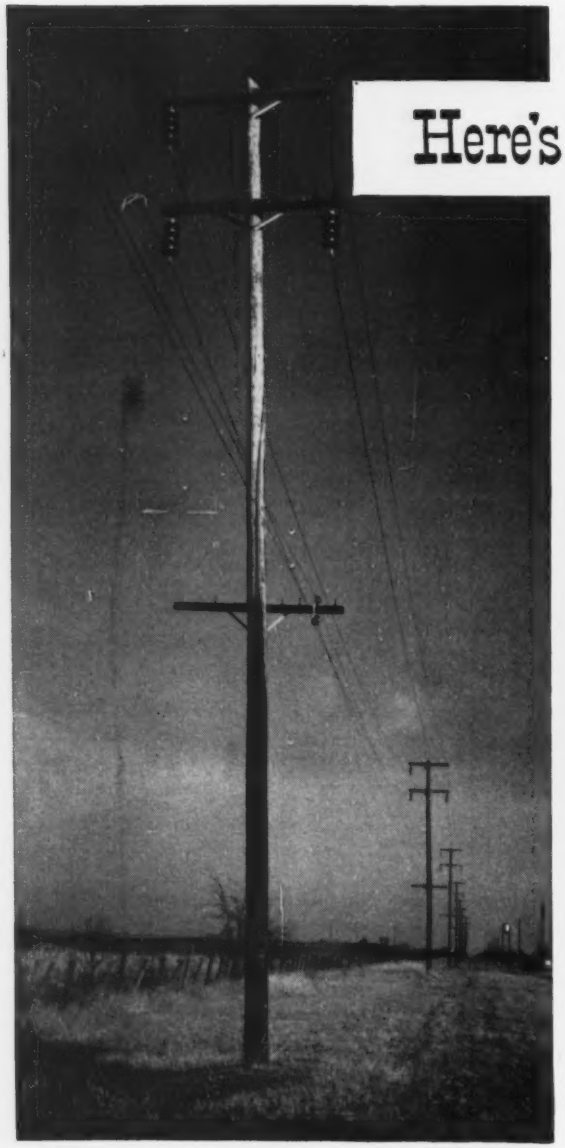
Standard

THE STANDARD TRANSFORMER COMPANY

Trade Mark ®

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES



Here's Proof of Performance...

Texas Power and Light Company reports on 630 creosoted poles installed in 1913:

90% still in service

40-YEAR-OLD CREOSOTED POLES in Texas Power & Light Company's line between Ferris and Corsicana, Tex.

CLOSE-UP of another pole in the section showing its excellent condition at the ground line.

TEXAS Power and Light Company in 1913 installed some 630 creosoted poles in the section between Ferris and Corsicana, Tex.

After 40 years of exposure to intense summer heat and wintry weather, 90% of the original poles are still giving excellent service. And officials of the T. P. & L. Co. estimate there are still years of life left in the creosoted poles—equal to the total life of untreated poles.

This kind of service is typical of poles treated with Creosote, and it's the major reason why Creosote is the first choice of preserved wood users.

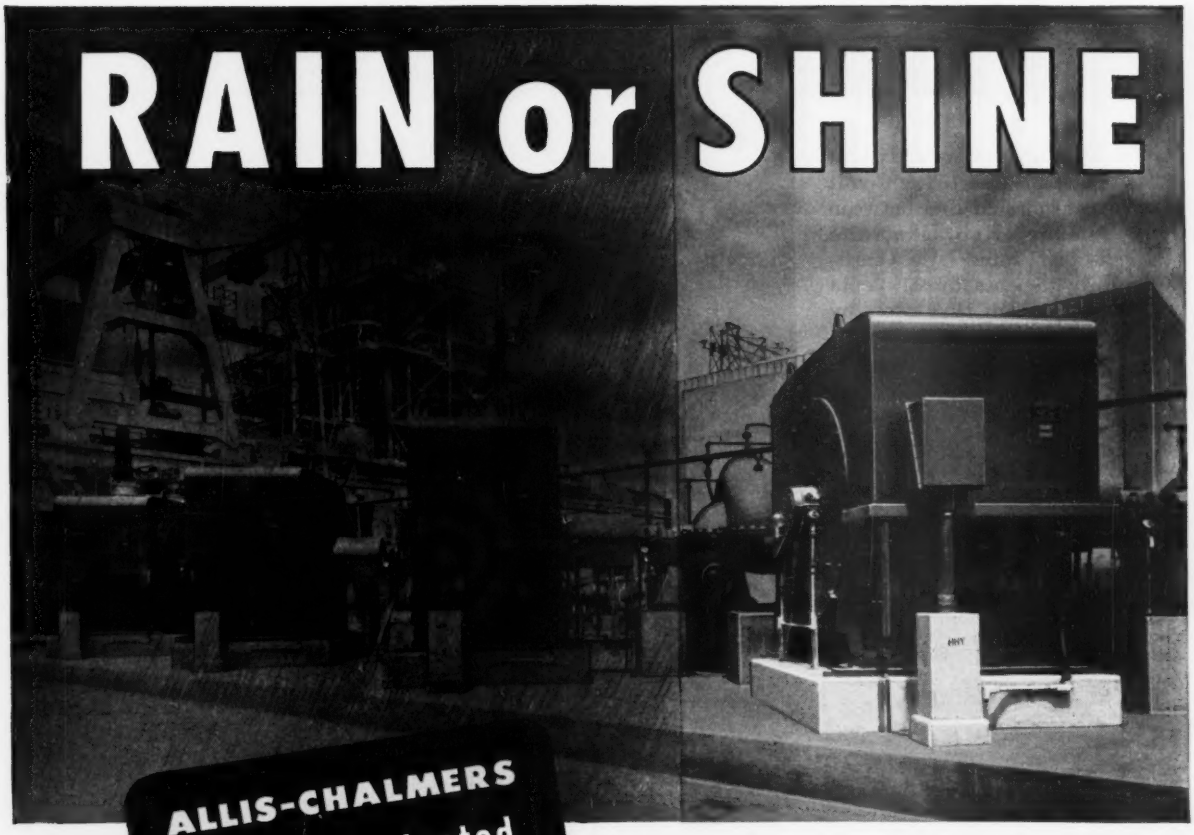
You can count on the *finest* performance with pressure-creosoted wood when U·S·S Creosote is used. U·S·S Creosote is a uniform product, made by continuous processing in the world's largest tar distillation plant. For complete information, contact our nearest Coal Chemical sales office, or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

U·S·S CREOSOTE

3-872

UNITED STATES STEEL

RAIN or SHINE



ALLIS-CHALMERS
Weather-Protected MOTORS

Low-cost outdoor installation plus dependable operation under all weather conditions

Economy plus reliability — regardless of weather conditions — was the combination demanded by Southern California Edison for the circulating water pump motors at the 250,000-kw Etiwanda Steam Station. And that's the combination delivered by the four Allis-Chalmers motors shown above.

Each of these modern weather-protected squirrel-cage motors is rated 900 hp, 4160 volts, 435 rpm. Smaller motors of similar design were supplied by A-C for the station's condensate booster pumps.

Proved by Special Tests

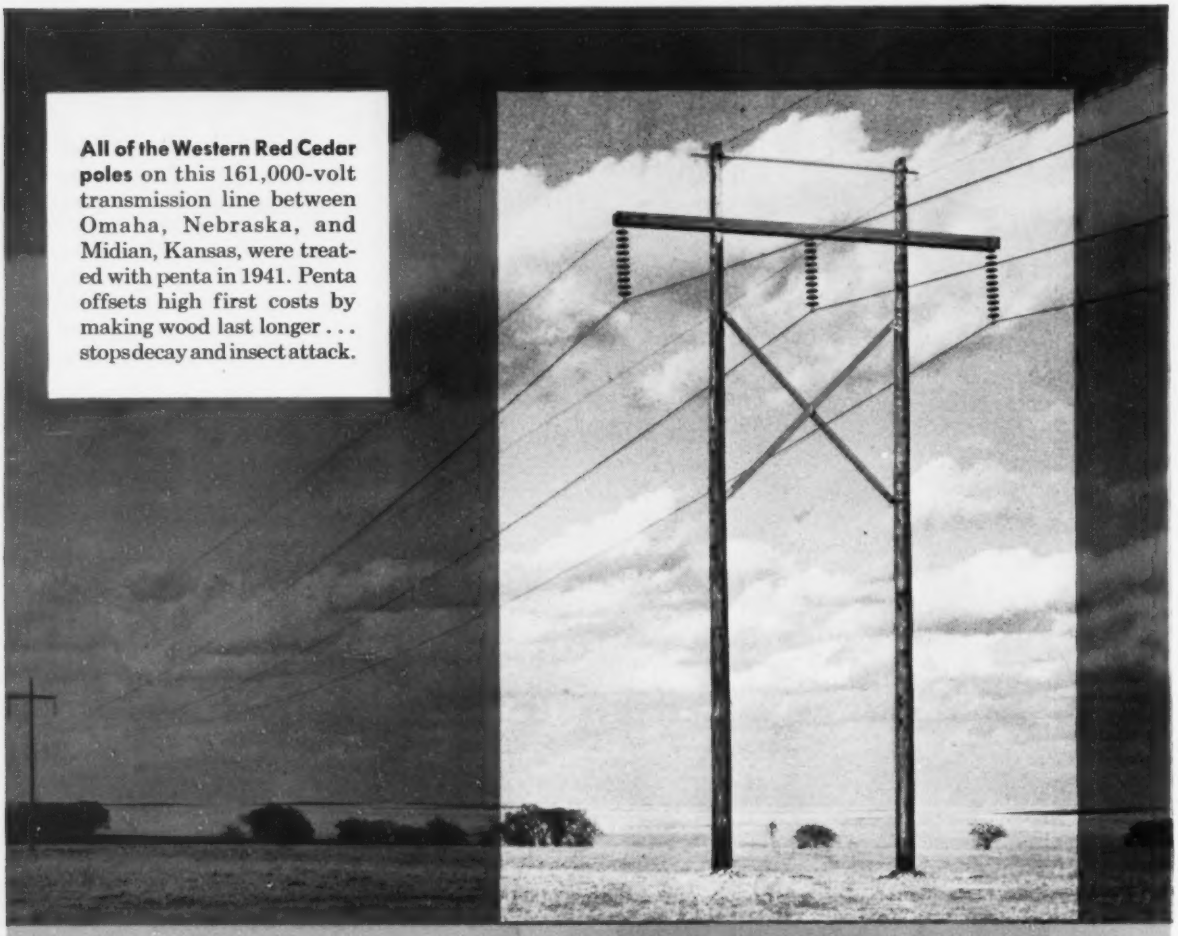
The weather-protected design has been tested under extreme conditions. Running at normal speed and voltage, motors of this type were deluged with water at rates up to 40 inches per hour — driven by winds up to 75 miles per hour. This was done repeatedly from all angles, but on inspection no moisture was detected on the windings. And other tests checked effectiveness in keeping out wind-driven fine sand — a serious threat at this west coast installation.

Movie and Bulletin Available

See how A-C test-proved these motors. Ask your A-C representative to show you the 12-minute movie *The Sky is the Roof*. Or write for Bulletin 05B7874. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4176

ALLIS-CHALMERS



All of the Western Red Cedar poles on this 161,000-volt transmission line between Omaha, Nebraska, and Midian, Kansas, were treated with penta in 1941. Penta offsets high first costs by making wood last longer . . . stops decay and insect attack.

MONSANTO PENTA protects capital investment in poles

Penta offers lasting protection to any exposed wood construction. Rain will not wash it out . . . insects won't eat the wood. Lumber treated with life-giving penta is *clean* and cost is surprisingly low—a premium that is paid back many times over in replacement savings.

Wood treater: Page & Hill, Inc., Minneapolis

***KEEP** this informative booklet for reference. Titled "Poles and Crossarms," it lists wood treating directions and specifications. We will send you a copy on request. Monsanto Chemical Company, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.*

PENTA

MONSANTO
CHEMICALS – PLASTICS

Serving Industry . . . Which Serves Mankind

SORGEL AIR-COOLED Dry-Type TRANSFORMERS

Top Quality Time Tested

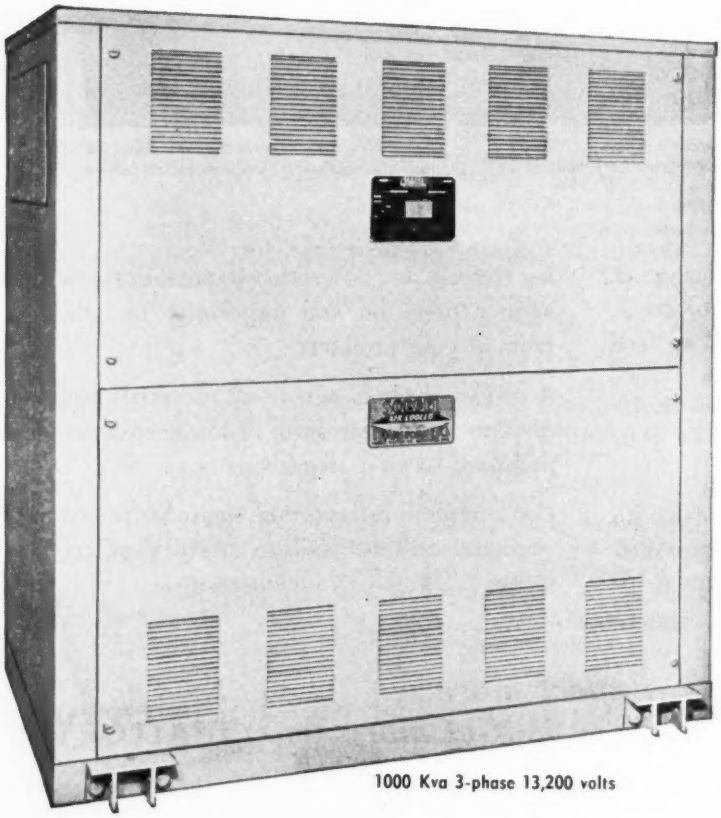
SORGEL dry-type transformers are preferred because of their cost-saving features and years of dependable service.

Easy installation—
Attached mounting brackets

Easy connecting—
Roomy connection compartment with solderless terminals.

Rugged construction—
Totally enclosed in steel.

Liberal design—
High efficiency.
Low noise level.



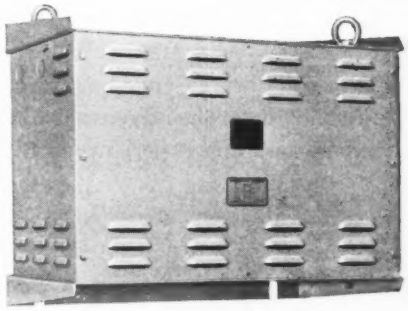
1000 Kva 3-phase 13,200 volts

Complete Line

¼ Kva to 1500 Kva single phase.
1 Kva to 3000 Kva 3-phase, 2-phase and phase changing.

All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, up to 15,000 volts, and any intermediate or special lower voltages.

¼ Kva single phase 480/240 to 240/120 volts



20 to 50 Kva 3-phase. Wall mounting type

Also Substations — Special Transformers — Reactors, D.C. Saturable

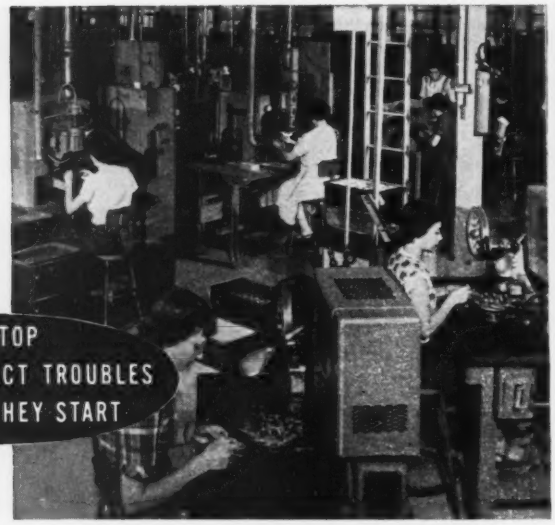
Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 834 West National Ave., Milwaukee 4, Wis.

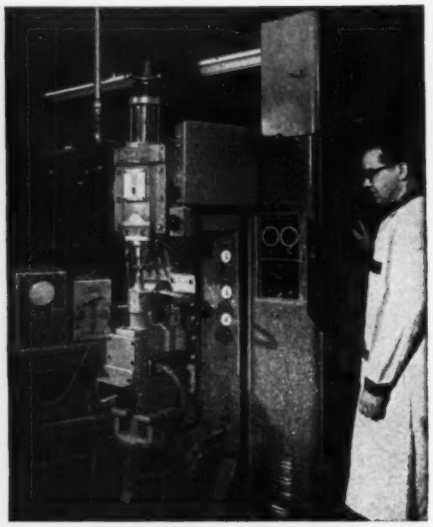
Pioneers in the development and manufacturing of Air-Cooled Dry-Type Transformers—Over 35 years

What a Combination!

For better contact assemblies . . . EXPERIENCE—35 years . . . FACILITIES—include complete resistance welding equipment.



These resistance welders occupy a part of 100,000 feet of floor space devoted to contact production.



Resistance welding machine in the Mallory Contact Engineering Laboratory.

The complete facilities for making contact assemblies at Mallory include spot, projection, tape and point welding machines . . . as well as five types of brazing equipment. Thus, Mallory engineers are unrestricted in their choice of the one best assembly method to fit your particular needs.

When you bring your contact problems to Mallory, you get the advantage of an unequalled source of data and experience in resistance welding techniques . . . another important factor that assures precision and uniformity for the contacts in your products.

A complete range of contact materials and production methods results in lower cost contacts produced to your requirements.

For complete information, write us today. Our engineers will be glad to study your requirements . . . answer your questions.

Expect more . . .
Get more from **MALLORY**

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

Electrical Contacts and Contact Assemblies

P.R. MALLORY & CO. Inc.
MALLORY

SERVING INDUSTRY WITH THESE PRODUCTS:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

P. R. MALLORY & CO. INC., INDIANAPOLIS 6, INDIANA

Regohm Circuit Controller, shown at actual size, with cover removed. Designed, developed and manufactured by the Electric Regulator Corp., Norwalk, Conn.

1/10¢ lengths of BH "649" ride the thermometer

Small enough to fit in the hand . . . it can control energy millions of times greater than that needed to activate it. That's the Regohm, manufactured by the Electric Regulator Corporation. It is a compact, versatile control component of the direct-acting finger type with wide acceptance as a voltage, current and speed regulator.

Electric Regulator engineers said, "We needed an insulation that would be permanently flexible through high and low temperatures. We found what we needed in BH "649" Fiberglas Tubing, and got these added advantages: BH "649" is easy to handle, it slips over wires quickly and speeds assembly time. It withstands the roughest handling without damage. It can be cut in short lengths without fraying or cracking. Its smooth, glossy surface adds to the appearance of our products."

BH "649", pioneer in the field of vinyl plastisol tubings, now offers true Class B protection at 130°C. with its improved coating formulation. Rated dielectric strength and flexibility continue after exposure to 150°C. for 300 hours, 200°C. for 20 hours, 232°C. for 3 hours—and for even longer periods if not abused after conditioning. Its resistance to chemicals and oils, as well as its high physical strength, has helped solve many tough insulation problems in a wide range of applications.

Why not investigate the advantages of BH insulations today. BH "649" is just one of a large family of Fiberglas tubings and sleevings developed specifically for the electrical industry. If you'll send facts on your requirements—voltages, temperatures, unusual conditions—we'll be happy to make recommendations and send samples for testing.

Bentley, Harris Manufacturing Co.
1111 Barclay Street
Conshohocken, Pa.

BH FIRST IN

use of Fiberglas
heat-treated Fiberglas
true high temperature flexibility
vinyl-coated Fiberglas
silicone rubber coating
colors in silicone rubber
true Class B (130°C.) protection

BH Fiberglas* SLEEVINGS

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp

Here's the Current Transformer You've Been Asking For!

New MOLDED CURRENT TRANSFORMERS

for 600-Volt Indoor or Outdoor Service

Maintenance Eliminated! This new "thru-type" current transformer is molded in thermo-setting resin. There is nothing to deteriorate . . . plastic never requires painting. Only secondary terminal studs and base mounting studs project through the plastic — a perfect seal is established at these points, thanks to the high adhering properties of the plastic. The projections are threaded and non-corrodible. You get excellent resistance to weathering.

Installation Simplified! The transformer is small and compact. Installation time is reduced because there are no bolted connections — a feature of "thru-type" design. Future changes caused by load growth are simplified too. An elliptically shaped window (1⅜ by 2¾ inches) has plenty of room for two 500 MCM conductors with 600-volt insulation.

Secondary terminals are on top of the transformer to permit closer mounting . . . you can connect secondary leads from either side. The secondary terminals are protected by a weather-resistant sealable cover. You can substitute a condulet box if desired.

A-4181

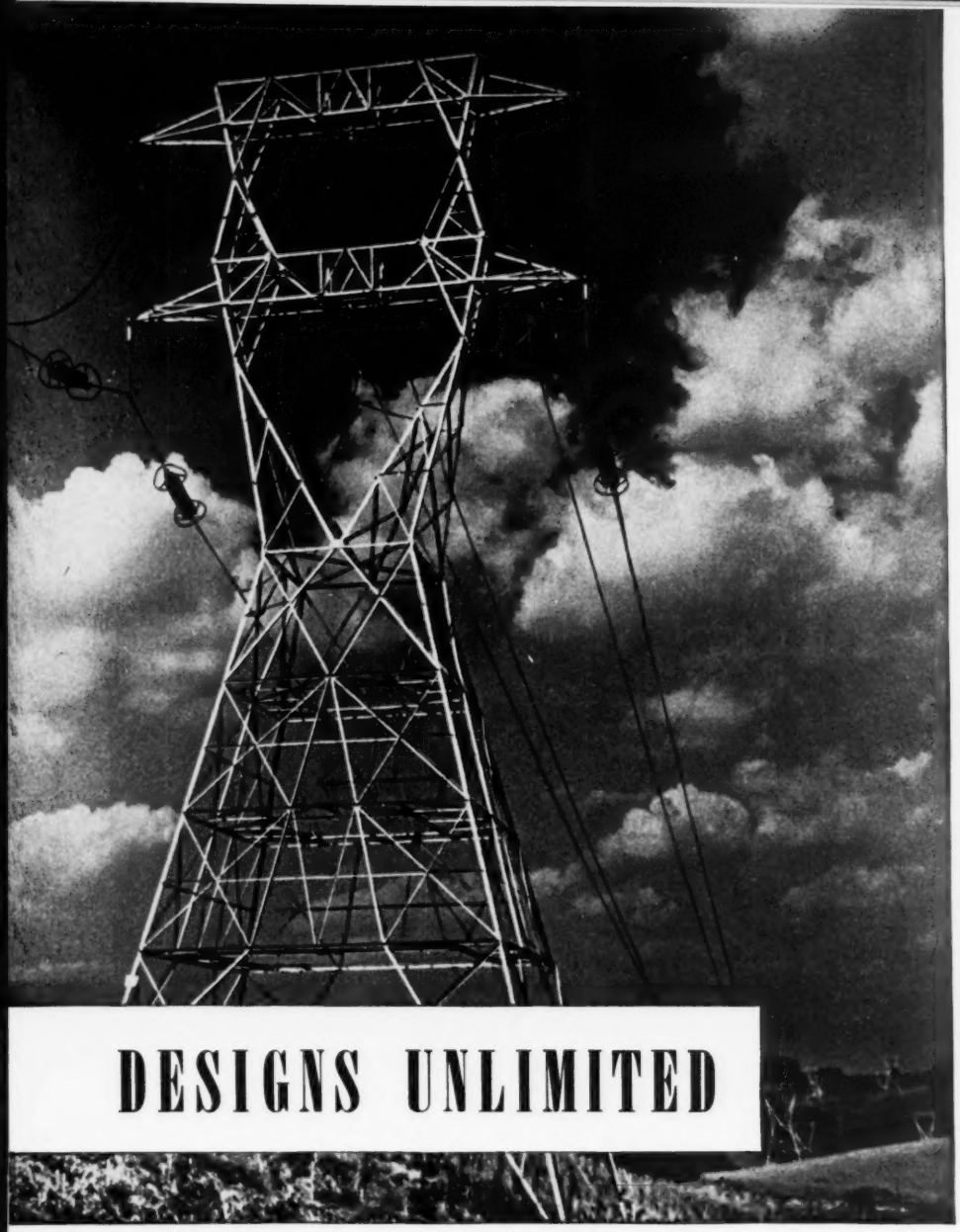
4 Ratings — Current ratings available in type TWM with line conductor passing once through the primary window are: 200 to 5, 400 to 5, 600 to 5, and 800 to 5. Intermediate ratings may be obtained by looping the primary conductor through the window two or more times.

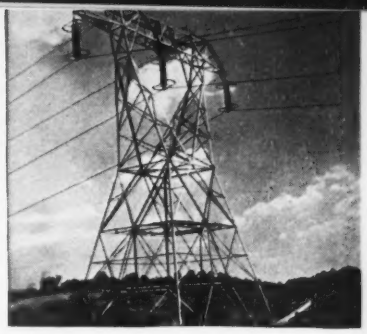
Type TWM transformers have conventional accuracy for light burden metering. The 200-amp rating has ASA accuracy classification of 0.3 with burden B-0.1 and 0.6 with burden B-0.2. The 400, 600, and 800-amp ratings have 0.3 accuracy at burdens of B-0.1 and B-0.2.

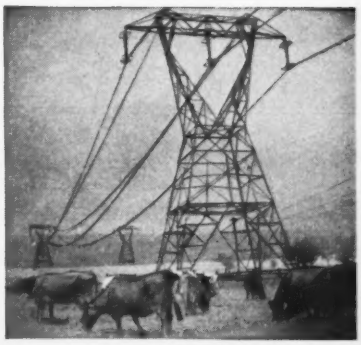
For complete information, call your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

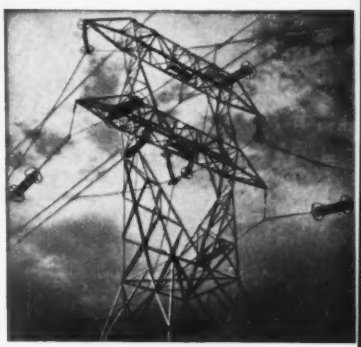
A-C ALLIS-CHALMERS

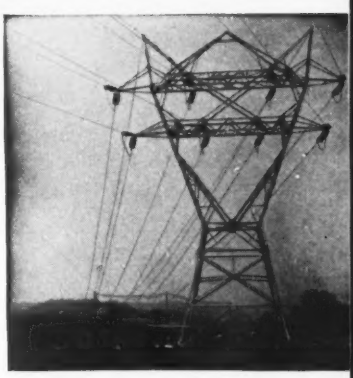
ALLIS-CHALMERS











DESIGNS UNLIMITED

If your engineers have their own ideas on tower design, well and good. We will follow them to the letter and adhere closely to specifications. Your engineers realize, as we do, that despite general similarity no two towers are alike. Each tower must be designed for its particular location and purpose.

Let us apply our four decades of experience in building towers for any and all conditions of terrain and load to your power transmission problems.

BLAW-KNOX

BLAW-KNOX COMPANY
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PITTSBURGH 22,
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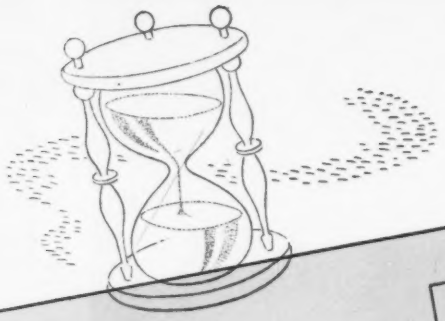
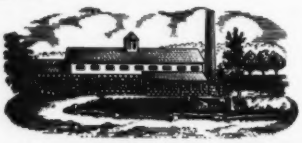


KERITE
CABLE-GRAM

QUALITY IS THE PRODUCT OF INTEGRITY. ALMOST 100 YEARS OF UNFALTERING ADHERENCE TO THE HIGHEST STANDARDS OF MANUFACTURE HAS MADE QUALITY AN INHERENT COMPONENT OF KERITE INSULATED CABLE. ITS DEPENDABLE PERFORMANCE HAS BEEN MEASURED BY TIME, THE ULTIMATE TEST OF ENDURING QUALITY. ITS PROPERTIES, STILL UNRIVALED TODAY, MERIT CONTINUED USER CONFIDENCE.

THE VALUE AND SERVICE LIFE OF A PRODUCT CAN BE NO GREATER THAN THE INTEGRITY AND CRAFTSMANSHIP OF ITS MAKER.



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Let's Get the Basic Data on House Heating

Regarding the characteristics of the house heating load, much has already been indicated. But little has been solidly established by research, test, and experience. That little justifies hardly more than tentative approach to the problems of investment, rates, engineering, and sales posed by the new load.

In this issue are several articles on various aspects of house heating—methods of heat control, calculation of energy needed for heating, user experience, and requirements laid by the load on distribution systems. From working on these articles and others on the same subject previously published and from consideration of much material that was not published, one gets the impression that utility research in this field has gotten off to rather a bad start.

One reason for this feeling is the preponderance of concern with the user aspect of electric house heating that appears in practically every utility study of the load. Of course the utility is properly concerned with all of the factors that affect customer acceptance of electric house heating—cost, engineering of installation, thermal insulation, thermostat settings, kinds of heating equipment. They are the determinants of the characteristics of the load.

But it is these characteristics, not what determines them, that the utility needs most to think about. In the final analysis and although the utility can do much to advise and instruct, it is the customer who says what the load will be. And if people want and will pay for electric heat in houses open to the four winds, it is the utility's business to supply the electricity.

Another reason for our critical attitude towards utility research in this field is the fact that it occupies itself almost exclusively with the heating load per se. It is not the energy consumption, demand, diversity, and load factor of the heating load by itself that affect the utility. It is the combination of them with the characteristics of other loads that dictates engineering, fixes investment, and determines rates. House heating is a component of residential load and should be investigated, considered, and appraised as such, not as something standing apart and alone.

Load studies that depend on instrumentation in customers' homes and on their more or less conscientious cooperation can always be regarded with a suspicious eye. That's the way most research on house heating has been done so far. Because some customers will and some won't permit installation of instruments in their homes, the test sample is likely to be unrepresentative. If customers have anything to do with reading or operation of the instruments, the data obtained may not always be correct.

If house heating is considered not as a separate thing but as a component of total residential load, then research into its effect on load characteristics can be carried on much more easily than heretofore. Such research asks nothing of the customer because the meters that will tell the utility what it most needs to know can be installed outside his home. And the sooner a large and comprehensive body of such data is built up, the sooner utilities can find solutions for the problems that confront them in house heating.

Opportunity in Nuclear Power

In announcing the contract with Westinghouse for development of the first power reactor, AEC Commissioner Thomas E. Murray said, "The Commission will welcome offers from industry to invest risk capital in the building of the steam and turbine portions, as well as in the operation of the entire plant."

Even though the basic features of a government power development are inherent in this program, the door has been left open for participation by private industry. A utility or group of utilities may offer to build the "steam and turbine portion" with some hope of acceptance. Then such a builder undoubtedly would get a priority upon the operation of the entire plant as an additional source of power. The problems of investing in or owning a nuclear power reactor would not have to be confronted. So the high cost of the experimental portion of the unit would be carried by the government.

It appears that this opportunity to participate in the construction and operation of a full-scale power reactor and related power producing equipment should receive careful consideration by the electric utilities.

Appliance Installation Costs

You pay $300 for an electric dishwasher, then $280 more to get it installed; $255 for an electric range and $175 for installation; $132 for an electric water heater and $200 for installation; $245 for an electric clothes dryer and $125 for installation; $130 for a garbage disposer and $190 for installation.

Ridiculous, of course. But that's the way the average retail values of these appliances, derived from "Electrical Merchandising" statistics, stack up against the maximum installation costs of them, taken from a survey made by the major appliance division of the General Electric Co. Results of this survey are summarized in this issue.

Ridiculous, indeed, is such comparison of appliance prices and installation costs. But it is the ridiculousness of fact, for there are places in this country where the cost of installing appliances is an almost insurmountable obstacle to the sale of them. These places are few, but any number of them is too many.

To whatever causes high costs of appliance installation are attributed, there is only one real cause. It is that the local utility does not want the appliances to be sold. If it did want them sold, the utility would see to it that installation costs were brought within a reasonable range. How else can be explained the fact that of two places only about 40 miles apart the customer pays through the nose in one and in the other he gets off very easily?

Management at the Crossroads

Some grave and far reaching implications for the electric utility industry were contained in the recent United Fuel Gas decision of the Federal Power Commission. This order was hailed because in it the commission finally exceeded a 6% return indicating a more liberal policy in treating the industry's requests for rate increases. But it soon became apparent that these hopes were ill-founded.

On Aug. 31 in filing for a rehearing, the company contended that the commission had erred in its determination of the rate of return. This, claims the company, should have been 6½ instead of the 6¼% allowed. And furthermore the commission substituted its own rate structure and tariff provision for those adopted by management.

Although a 6¼% return was approved, the company claimed that the rate schedule proposed by the staff provided an actual return of only 3.69%. But the more important question was whether the commission had any right in setting individual rate schedule without interfering with the prerogatives of management.

On this subject the petitioner had this to say in its brief for a rehearing:

"Throughout the opinion the commission has accepted the recommendation of the staff on practically every point of managerial policy where the staff and the applicant have disagreed.

"It is difficult to understand why this commission would assume that on the vast majority of points wherein the management of applicant and the staff have differed, the management is in error."

Within the ambit of our regulatory laws management, if it so desires, can still be supreme. While it's the commission's duty to find the fair return on the fair value of the property and to see that rates are not unduly discriminatory, it has no right to enter what is probably the most sensitive of managerial prerogatives, the field of pricing.

The electric industry should consider the full implications of the commission's action. The pattern of this decision does not sound encouraging.

Metering the Welding Load

A watthour meter disk will take time to get up to the appropriate speed when a given constant load is applied, and it will take time to come to rest. If these times are equal there will have been no registration error on the part of a correctly calibrated meter. Usually these times will be less than a half-second each and not absolutely equal. Friction and wave form will vary the departures, but the biggest influence will be trigger-finger sensitiveness of the light-load adjustment. Any predisposition to creep can lead to sizeable errors under extreme conditions such as loads that give an accelerating period of a few cycles.

These phenomena have been recognized as the seat of the uncertain registration of watthour meters on welding loads. Pinning down of the deviations by Professors Faucett and Keener at University of Illinois has done much to resolve the uncertainty.

Generally speaking their studies indicate that the errors are usually within permissible limits unless the distortion factor is 30% or higher or other factors conspire to be adverse. This is where welding enters the picture as a load that often offers adverse combinations of characteristics. Electronically controlled welders which are timed by using only a portion of the power cycle may present distortion factors up to 80%. In conjunction with this wave-chopping the power factor may also be low. Under these circumstances the meter may run as much as 10% fast.

This new information about watthour meter registration of welding-load consumption should simplify the problem of setting rates for the service. Generous allowance for meter discrepancy can be set aside, and the attention put on carrying charges for the extra service facilities for welding.

THE ELECTRICAL WEEK

The Issue's News Highlights—Industrial power reactor program in U. S. is now definitely under way as a result of contract granted Westinghouse by AEC for construction of first large scale nuclear-fueled power plant.

Trend toward standardization on general purpose meters for residential services was noted at joint meeting of EEI-AEIC meter committees . . . Call for long-range distribution system planning was sounded at Austin Power Distribution Conference.

Reports that Alabama Power was in the market to purchase properties of TVA were denied by Chairman T. W. Martin. He said the company had given "no thought to the purchase of all or any part of the TVA property." Martin added his company and TVA had cooperated in many ways in recent years in power emergencies and in the purchase and sale of small amounts of power.

Memphis (Tenn.) Light, Gas & Water Division strike ended Oct. 20 as employees settled for 5½% wage hike compared with 10% requested.

"We will not oppose it," was the comment of Undersecretary of Interior Ralph A. Tudor when a group of Washington state public utility districts proposed to file for an FPC permit to build a high dam in Hell's Canyon of the Snake River.

New Units on the Line—Connecticut L&P has placed in operation first of two 5,000-kw gas turbine units at Thompsonville. Another two will be added at Danielson . . . TVA has put into operation the third 135,000-kw unit at Shawnee steam plant.

At NRECA Region III meeting, co-op representatives from Alabama, Kentucky, Tennessee, and Mississippi passed a resolution urging the federal government to use atomic energy for generation of low-cost electricity. Another resolution stated that unless the government constructs additional power plants, the prospect of acute power shortage will develop in the area.

Interior Department offered to reopen negotiations on a contract which would permit Provo River Water Users Association to build a 5,000-kw hydro plant at Deer Creek Dam in Utah. Former Interior Secretary Chapman rejected a previous proposal by the association to erect the plant, urging instead that the federal government undertake the project.

Taxpayers now have an investment of $1,741,800,000 in TVA the agency revealed. Although revenues went up $10 million in the last fiscal year, net power income dropped from $25.1 million to $18.6 million.

Five Washington PUD's filed a petition with the Washington PSC asking a rehearing and reconsideration of its order approving a merger of the Puget Sound P&L and Washington Water Power (see p 102).

Off the Washington Wire—Drought conditions are keeping water levels well below normal in power reservoirs over much of the country. But in the West and Northwest runoff is normal to well above normal, according to latest geological survey report.

The 4½-mile tunnel which will carry water for the Eklutna hydro project in Alaska has been holed through. Started in October of 1951, the tunnel under the Chugach Mountains was bored from both sides. It was within one-half inch of alignment when crews broke through near the center point.

AEC has approved a proposal by Newport News Shipbuilding & Dry Dock Co to study application of nuclear power for ship propulsion . . . Diamond Alkali Co is a new associate in the Foster Wheeler-Pioneer Service group studying feasibility of nuclear power for industrial use.

FPC has denied a motion by National Hells Canyon Association to require Idaho Power Co to revise its application for a license to develop the Hell's Canyon Site on the Snake River.

Reorganization of the Bureau of Reclamation is in the works.

Colorado Central Power Co will begin paying in January common stock dividends on a monthly basis. First payment will be 10¢ a share to stockholders of record Dec. 17. Company paid 28¢ a quarter in 1953 and 25¢ a quarter in 1952.

Delegates to American Gas Association annual convention heard FPC Chairman Jerome K. Kuykendall say the government had no intention to setting rates for service that would "impoverish" utilities.

Kentucky's Court of Appeals has ruled Paducah citizens can't vote on Nov. 3 on the question of whether the city should buy facilities of Kentucky Utilities System there. The Court said an opinion would follow.

Santee-Cooper is planning to install 300,000 kw steam capacity as an addition to the 100,000-kw thermal station now being built adjacent to the authority's Pinopolis hydro plant. First of two 50,000-kw units at the steam station has just gone on the line.

Federal Power Commission authorized Wisconsin Michigan Power Co to buy a $1.5 million hydro plant on Menominee River in Wisconsin from Kingsford Chemical Co.

Congratulations—Norman A. Cocke, Sr, vice president of Duke Power Co, was elected president of the utility to succeed the late E. C. Marshall . . . H. Sherman Holcomb was appointed a vice president and general manager of the Essex County Electric Co, Salem, Mass.

Nuclear Power Program Is Launched

AEC asks Westinghouse to build nation's first large-scale atomic reactor power plant

Although the first nuclear-fueled plant generating sizable blocks of electric power will be built with federal funds, Atomic Energy Commission has made it clear that it is counting on active participation by private industry to get an industrial power program rolling.

In announcing that AEC had asked Westinghouse Electric Corp to build a 60,000-kw atomic reactor power plant (EW, Oct. 26, p 8), Commissioner Thomas E. Murray declared he was convinced federal financing and sponsoring of full-scale power reactor development would "fall far short of what is needed unless there are enlisted in this cause the cost-cutting drives, the know-hows, skills, and competition of many segments of America's business and industry."

Murray spoke before the annual workshop conference of the Electric Companies Public Information Program at Chicago Oct. 22.

Cost Factor . . . Believing that even if the Atomic Energy Act were amended private companies would not aggressively enter the power reactor development field because of the tremendous costs involved, the commission decided to finance the first such project, Murray said.

But, the AEC commissioner added, "The commission will welcome offers from private industry to invest risk capital in the building of the steam and turbine portions, as well as in the operation of the entire plant."

In order to permit wider industry participation in the atomic reactor program, Murray urged the end of the monopoly of power reactor information shared by the government and a few industrial firms. He said the "proposed policy calling for both Government and private efforts in the nuclear power field, is an interim policy. As privately financed efforts gain momentum, the work should gradually be transferred from the federal government so that eventually industry will be carrying the greater part of the burden of this industrial development."

Murray: "Private enterprise and private capital are invited to participate" in AEC's project to build first large-scale nuclear fueled power plant

More Research Needed . . . But Murray warned that simply changing the Atomic Energy Act to permit more industry participation would not solve technological problems involved in constructing atomic power plants. He said a large part of the research and engineering job still remains to be done.

Basic problem to the question of industrial participation, Murray pointed out, is the need for secrecy. Such secrecy, he said, is made necessary by concern that the Soviet Union would capitalize for war on our reactor technology. This need for secrecy, however, should not be made the basis of demand for government ownership of nuclear power industry, he emphasized.

In an apparent reference to General Electric Co's proposal to build a reactor which would produce both power and plutonium (EW, Oct. 26, p 8) Murray declared the commission is

Murray stresses private industry and capital will be called on to participate in program

"soft pedalling" this type of dual reactor. Reason, he said, is that present plutonium needs are being taken care of by reactors in operation or under construction.

GE has formally submitted its proposal to AEC, but there is little likelihood it will be accepted in view of the commission's contract with Westinghouse.

Industry View . . . AEC's action in authorizing Westinghouse to build the atomic reactor plant brought immediate praise from one of the power industry's leading spokesman on matters relating to atomic power. Edgar H. Dixon, chairman of Edison Electric Institute's Committee on Atomic Power, declared:

"Naturally . . . we applaud the further efforts by Mr Murray and his associate commissioners to open the doors for a greater participation by industry in the furtherance of atomic power development. I feel certain that our industry will have a keen and active interest in exploring with the Atomic Energy Commission the bases upon which it may be possible to invest risk capital in the building and operating of this or other new power reactors which may be sponsored by the commission."

AEC hopes the Westinghouse reactor plant will be in operation within four years. It is probable, however, that work will not start on the plant within a year.

Valuable Data . . . The Westinghouse project should provide scientists and engineers with a wealth of data on design, construction, and operation obtainable only from a working model. Power company officials will be keeping close watch on such items as plant cost, efficiency, and dependability of this government-controlled plant.

AEC is skipping over the pilot plant stage—going directly to a full-scale plant for its debut in the industrial power field. The facility, generally patterned along the lines of a regular medium-sized steam-electric gener-

ating plant, will be tied in with an integrated electric system.

This first nuclear-fueled plant likely will be located in the vicinity of Portsmouth, Ohio; Oak Ridge, Tenn.; or Paducah, Ky., to help furnish electricity for AEC's vast gaseous diffusion plants. Portsmouth seems to be the probable choice because power requirements are greater there than at the other two projects. But purpose of the Westinghouse plant will be mainly experimental.

What Will It Cost? . . . A cost ceiling was not disclosed, but it is estimated the atomic reactor and the conventional portions of the generating plant will cost between $30 and $40 million. This is well over twice the cost of a coal-burning generating plant of this capacity.

Nobody expects that this plant will come anywhere near producing power at costs competitive with those from coal-burning plants. But it should give some fairly reliable guides as to future costs of turning out usable power from nuclear sources.

This is the kind of economics that the atomic engineers are playing around with:

Capital plant expenditures for a conventional power generating plant run from $160 to $200 per kw of capacity. If operated at about 70% of capacity—which is above average demands—a rate of 3 to 4 mills per kwhr is needed to return this investment. Add to this the fuel costs of 2 to 3 mills and you have a cost of production ranging from 5 to 7 mills per kwhr.

Now it is believed that fuel costs from nuclear sources will run about 2 mills or less per kwhr. Until more data is available, nobody has a very clear idea of what the capital costs of an atomic power plant will be. They know to be competitive it can't be much over $200 per kw of capacity and that is the far-off goal.

On this first plant, AEC probably will be pleased if it can keep the cost down to $500 or $600 per kw—which would mean a total project cost of at least $30 million.

Past Experience . . . In designing the first big atomic power plant, Westinghouse engineers will not be starting from scratch. The plant will contain a pressurized-water reactor (power). Westinghouse was well along on an aircraft carrier power plant featuring this type of reactor when the whole project was dropped earlier this year because of changing military requirements. But it is expected that a considerable part of the carrier work will be carried into the industrial-type power plant.

REAR ADM H. G. RICKOVER will supervise reactor power plant project

Rickover Is Supervisor . . . The new project inherits the supervisor of the carrier project, Rear Adm. Hyman G. Rickover, who has also been in charge of the submarine reactor propulsion program.

Electric utility officials and some AEC scientists who are counting on the power reactor to give a lot of answers on economic feasibility are none too happy over the Rickover assignment. They feel that any Navy man, intentionally or not, might tend to guide the power reactor development toward shipboard utility.

Main difference between a carrier-type reactor and a power reactor is in compactness and shielding. An intensive effort to achieve compactness or light-weight shielding—both characteristics highly necessary for naval use—would skyrocket costs without contributing much to industrial reactor development. This would discount much of the value of the project as it relates to the question of economic feasibility.

To prevent the power reactor program from straying, AEC has forbidden the expenditure of additional funds or time on adaptations that would promote the shipboard utility of the power reactor.

Progress Reports . . . The five industrial teams studying the feasibility and design of atomic power generating plants will have access to progress reports on the project from beginning to end.

AEC first produced electricity from the atom at its experimental breeder reactor in Idaho Dec. 21, 1951. Rated capacity was 150 kw. In March of this year, it turned out some more power from its homogenous reactor at Oak Ridge. The submarine-propulsion reactors are also capable of turning out power. They are rated at about 15,000 kw.

The decision to go ahead with this promising industrial application of atomic energy was not without diplomatic overtones. It was announced as the peacetime answer to the recent Russian weapon tests.

On the surface, at least, it indicates there is enough slack in the U. S. atomic weapons program to permit the diversion of technicians and materials to civilian projects.

Charles Wilson Heads Light Jubilee Committee

Charles E. Wilson, former president of General Electric Co, last week was named chairman of the sponsoring committee for Light's Diamond Jubilee. The committee will take the leadership in a nationwide celebration of the 75th anniversary of Edison's invention of the incandescent lamp.

Wilson, now chairman of the executive committee of W. R. Grace & Co. expects to announce other members of the sponsoring committee within the next few weeks.

The Jubilee executive committee, headed by D. C. Luce, Public Service Electric & Gas Co vice president, and the program committee, under the direction of Ralph P. Wagner, Niagara Mohawk Power Corp, are already at work on plans for marking the anniversary. Celebrations are planned in 500 communities in 43 states and the District of Columbia.

PARTICIPANTS at the AEIC-EEI Joint Meter and Service Committee meeting included P. H. McCance, Duquesne Light Co president, H. H. Marsh, AEIC chairman, and C. V. Morey, EEI chairman. McCance presented the Pittsburgh redevelopment story at luncheon meeting

Standardization of Meters . . .

. . . for most residential services seems nearer realization, discussion at EEI, AEIC meter committee meeting indicates

Movement toward standardization on a general purpose watthour meter for essentially all residential services up to 100 amp was evident at the recent Pittsburgh meeting of the Edison Electric Institute and Association of Edison Illuminating Companies Meter and Service Committees.

A new 15-amp extended range meter was presented for this application by O. K. Coleman, vice president, Duncan Electric Manufacturing Co. His data indicate that high load capability has been achieved without sacrificing performance during light load periods. The advantages are comparable, he said, to the change from 2-wire to 3-wire services 20 years ago.

Approval Expressed . . . Following closely after Sangamo Electric Co's offering of a meter designed for 100-amp residential services, Coleman's announcement was welcomed by the committees. Members felt the objective of two sizes of general purpose meters—one for 100-amp services and the other for 200-amp services—now seems certain of attainment.

Large Type A meters will require disconnecting blocks capable of 200-amp loading, said W. G. Knickerbocker, Detroit Edison Co. He noted that there was a definite trend upward from 60 to 100-amp blocks with growing interest in 200-amp capability. With the 200-amp block, he said, will come a demand for meter enclosures large enough for 100-amp self-contained meters. And new attention to terminal size will be required, according to a survey results reported by J. N. Schwartz, Columbus & Southern Ohio Electric Co.

Galvanic corrosion of joints between aluminum wire and brass or copper meter terminals has not proved too troublesome, according to data presented by E. B. Hicks, Carolina Power & Light Co. Some of the committee members credited this success to careful covering of bi-metallic joints, while others cited limited installation of aluminum entrances.

Socket Deterioration . . . But meter sockets and clamping rings are proving more vulnerable to salt atmosphere attack. Several companies maintaining test racks at the sea coast reported rapid deterioration of aluminum sockets and other metal parts. Wind-driven sand aggravates the deteriorations, it was noted, and eventually etches the glass enough to prevent reading the registers. One company reported cypress box enclosures to be the only type of meter installation with reasonable life expectancy.

Cyclometer registers for watthour meters now have been perfected to the point where use should prove satisfactory, E. L. Keller, Duquesne Light Co, declared. Friction has been reduced to less than 0.2% registration even at light load, he said. And snap action eliminates split readings on all but the first dial, making for easy accurate reading, Keller pointed out. He said cyclometer registers can be adopted without reservation where policy demands direct reading. But, he noted, extra cost and more difficult maintenance block general adoption.

Grounding facilities on instrument transformers and polyphase meters will not be specified to the manufacturers, the committees voted.

PUD's to Consider Setting Up Agency to Build Dams

A meeting called for Nov. 9 at Ephrata, Wash., by Glenn Smithers, Grant County PUD manager, may result in organization of the state's Joint Operating Power Agency No. 1.

Representatives of all PUD's and municipal power systems in the state have been invited to attend. They will discuss and possibly adopt rules of organization of a power agency which, under a 1953 legislative act, could be empowered to build major dams and transmit power in the state.

Grant County PUD, in calling the meeting, said "it is willing to join one or more municipal or PUD agencies in forming the joint operating agency." It has been promoting construction of a two-dam project on the Columbia River at Priest Rapids.

Distribution System Planning . . .

. . . requires engineering imagination, Southwestern Public Service vice president tells Power Distribution Conference at Austin

It is time for engineering imagination in distribution system planning, H. O. Hodson, vice president, Southwestern Public Service Co, told the Sixth Power Distribution Conference held at Austin, Tex., Oct. 19-21.

The conference, sponsored by the University of Texas, attracted more than 300 distribution engineers from all parts of the country.

"It is foolish to build a distribution system today based on precedent," Hodson declared. "We must go to higher voltages to increase capacity and better protection systems to avoid loss of the large blocks of capacity involved in the higher voltage," he said. Hodson recommended the plotting of load curves on semi-log paper in order to get a better picture of trends.

Panel Discussion . . . Members of a panel discussing distribution system planning agreed that long range plans must be made to meet the requirements of rapidly growing loads and that as changes are made they should fit into that plan. The panel also agreed that more time must be spent on distribution planning for economical operation.

Relatively large air-conditioning installations moving into residential areas have brought the problem of providing three-phase service, W. C. Morris, Southwestern Gas & Electric Co, reported. On the Southwestern G&E system, he said, motors of 5 hp or less normally are served single-phase. Exceptions are made, however, Morris pointed out, if more than one installation of 3 tons (4½ hp) is going in at a time in the neighborhood so that they can be served from the same transformer bank.

In the discussion, attention was called to the problems of (1) voltage flicker and its effect on motor capacity and motor heating, (2) voltage unbalance on three-phase circuits and its effect on motor capacity and motor heating, and (3) close design of motor-compressor combinations that results in lack of motor capacity to meet the requirements of normal voltage unbalance or regulation.

Rapid increase of air-conditioning load makes it necessary to consider the use of network systems secondary voltages in excess of the present 120/208Y systems, J. B. Hodtum, Allis-Chalmers Manufacturing Co told the conference. A study should be conducted, said Hodtum, to determine whether this should be 240/416Y, 266/460Y, 277/480Y or 480 volt delta.

MEMBERS OF PANEL on distribution system planning are (seated, l to r) G. E. Schmitt, Lower Colorado River Authority; H. O. Hodson, Southwestern Public Service Co; Frank J. Meyer, Public Service Co of Oklahoma; and O. W. Sommers, City Public Service Board, San Antonio. Standing (l to r) are Lee Cook, Texas Power & Light; and Sam Sharp, Southwestern G&E

Oil Testing and Reconditioning . . . At a conference on transformer oil testing and reconditioning F. C. Doble, Doble Engineering Co, in an absentee paper drew three conclusions:

1. Development of economical oil maintenance procedures today are well under way.

2. Attention should now be directed at a study of the effects of oil on solid insulation in transformers under higher temperatures.

3. Important new criteria for improved new oil are needed. Doble discussed the new tests for moisture content clay treatment and accelerated oxidation now being used to guide oil maintenance programs. He also described a new indicating meter for field measurement of water content in a flowing stream of oil.

Three utility engineers described oil reconditioning and inhibiting practices in use on their systems. H. L. Miller said Houston Lighting & Power Co's cost of 16¢ a gallon for reclaiming and inhibiting high acid oil, although high, is still very attractive when cost of new oil is considered. F. O. December cited a cost of 7.2¢ a gallon as cost of reducing neutralization number from 45 to 13 and raising IFT from 17 to 41.9. L. C. Eubank, Texas Power & Light Co, said his company avoids use of old oil in new transformers, prefering to use it in circuit breakers. He also warned that oils should not be mixed.

Switching Circuit Problems . . . R. C. Van Sickle, Westinghouse Electric Corp, said that a solution of many problems of switching circuits with one or more banks of static capacitors appears possible through the use of a circuit breaker having a series resistance built into the interrupters of the breakers, bridging part or all of the interrupter. Such an arrangement holds voltages to 1.5 times normal and limits surge currents when switching parallel capacitor banks, he said.

Generator leads form one of the most important links in the power system and paper is the best insulation available to the cable industry, said M. H. McGrath, General Cable Co. Thus, it is a little surprising to find so little use made of paper insulation for cables used in this service, he said.

Predicted rapid growth in system loads in the next 10 to 20 years emphasizes the need for protection of equipment on the distribution system, H. M. Towne, General Electric Co,

declared in a discussion of lightning problems. Towne described a new valve type arrester and said that protection should be installed at the equipment it was to protect. Arrester life, he said, depends on the number of discharges per year and the size of the discharges.

Cathodic Protection . . . Cathodic protection engineers are not trying to stop all corrosion, said E. H. Thalman, Ebasco Services, Inc. The objective, he said, is the elimination of major corrosion at reasonable cost. The cost of complete protection would likely be prohibitive, he pointed out. Aim of protection engineers is to hold the cost of cathodic protection to 2% or less of the cost of the protected system, Thalman said.

Accelerated tests of aluminum connectors, using cyclic loadings which in some cases approached fault current conditions, were described by O. A. Boyer, Central Power & Light Co. Frequent application of sea water to connectors on the test rack formed a part of these tests. Boyer concluded that (1) aluminum can be made to work in contaminated areas, (2) inhibitors must be used, and (3) a cover to exclude atmosphere will delay the action of contaminants on any aluminum joint.

Connector manufacturers were in agreement that all aluminum connectors were desirable not only for joining aluminum to aluminum but also for joining aluminum to copper. Parallel groove clamps and compression connectors were preferred, they noted.

POWER BRIEFS

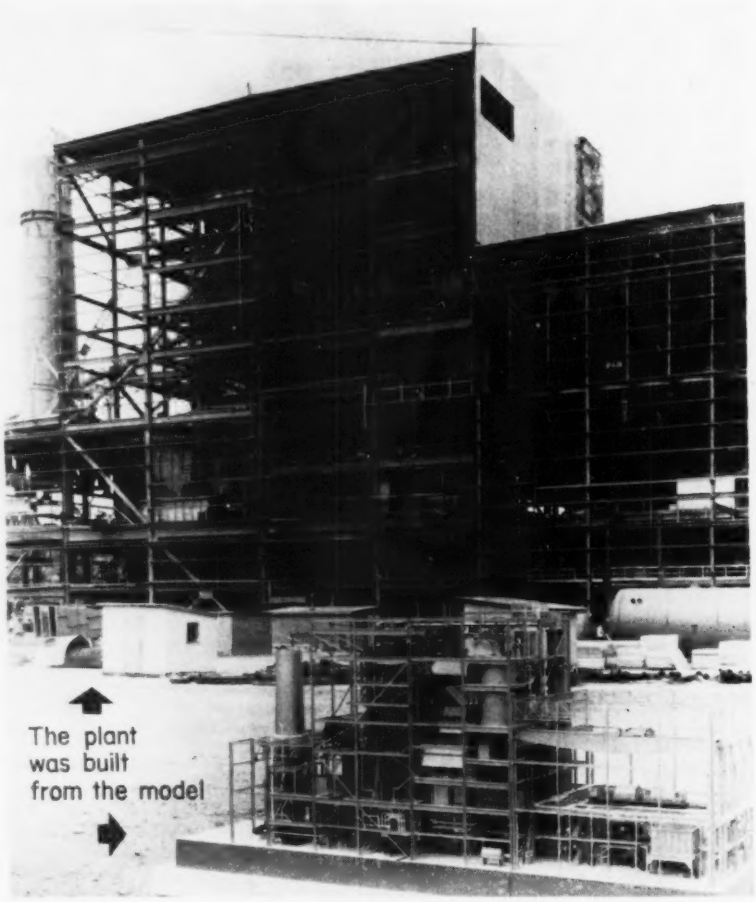
● Lower coffer dam gave way last month at Folsom Dam project on the American River near Sacramento, Calif., flooding the construction area. Water in some spots was 93 ft deep. Upstream coffer dam, which broke last winter and spring causing considerable damage to the project, held fast this time. Cause of the break, Army Corps of Engineers officials figured, was pressure from an increased flow in the river from a 2-in. rainfall and the collapse of a small pond upstream. Reconstruction of the coffer dam has permitted resumption of concrete pouring operations.

● A strong plea for construction of the $220-million Trinity River project in California was made by Reclamation Commissioner W. A. Dexheimer when he spoke Oct. 17 at a celebration marking the start of work on the Sacramento Valley Canals near Red Bluff, Calif. Dexheimer emphasized that the ultimate irrigation requirements of the canals, a part of the Central Valley Project, call for more stored water and more firm power than is available from CVP. The Trinity River development would add 1.6 billion kwhr to California's power output.

● Oregon advocates of a high federal dam at Snake River have lost another bid to get on a state-wide ballot in May the question of whether the project should be built by public or private interests. Attorney General Robert Y. Thornton ruled that the proposed ballot question does not constitute a law of constitutional amendment under Oregon's direct initiative and referendum code.

● Philadelphia Electric Co has purchased a 43-acre tract of land in Eddystone, Pa., as a site for a generating plant. Details of the new power station have not been formulated yet.

● Tennessee Valley Authority has established a government relations and economics staff which will be attached to the office of the general manager.



It is the very model of a modern major power plant

Built at a cost of $25,000, the scale model set off against the life-size plant above it saved more than $75,000 in engineering and material outlays in constructing Hartford Electric Light's new Middletown Steam Plant. Hartford officials said that working from the model speeded design and construction of the plant considerably. Scaled at ⅜ in. to the foot, it is 10 ft long and 4½ ft high.

DUQUESNE LIGHT CO's new polyphase metering box is explained to E. L. Schlottere, vice chairman of PEA's Engineering Section, and A. J. Keen, chairman of PEA's Meter Committee by W. E. Osborn and J. F. Kennedy. Schlottere indicates where meter assembly will be mounted

New Three-Phase Meter Box . . .

. . . developed by Duquesne Light Co is demonstrated at meeting of Pennsylvania Electric Association Meter Committee

Versatility and economy mark the new three-phase meter box demonstrated to the Pennsylvania Electric Association Meter Committee at its recent Lancaster, Pa., meeting by W. E. Osborn and J. F. Kennedy, of Duquesne Light Co. Designed for use with socket-type meters, the box is connected directly in the service for loads up to 100 amp or to current transformers for heavier loads. Prefabricated inserts provide proper metering connections for:

1. Three-wire delta 230-v—kwhr, kw demand, and reactive kwhr.

2. Three-wire delta 230-v—kwhr and kw demand.

3. Four-wire 120/208-v—kwhr, kw demand, and reactive kwhr.

4. Four-wire 120/208-v—kwhr and kw demand.

Economy starts with low cost of the box which is provided for the contractor to install, Osborne continued. And the convenient insertion and connection of metering equipment by utility personnel gives added savings. The same convenience attends changing metering as required by an increase or decrease in customer demand, he said.

Trend toward standardization was indicated by J. J. McFadden, Pennsylvania Power & Light Co, in his description of a uniform list of acceptable sockets and enclosures. Scranton Electric Co and the Luzerne Division of United Gas Improvement Corp, serving adjacent areas, have subscribed to the same listing. McFadden suggested that other Pennsylvania electric companies join the movement.

Stroboscopic testing is not sufficient for calibrating watthour meters, according to a report by E. H. Tyson, Pennsylvania P & L, and C. H. Cottle, Sr, Scranton Electric. Neither does jig setting eliminate the need to calibrate. But to attempt to hold error below 0.5% by any present method is not economical, they said.

Albright Station . . .

. . . is main topic of discussion at PEA Prime Movers Committee meeting at Morgantown

Main topic of discussion at Pennsylvania Electric Association's Prime Movers Committee meeting at Morgantown, W. Va., Oct. 19-20 was the new three-unit, 300-Mw Albright Station, jointly operated by Potomac Edison Co and Monongahela Power Co.

Eugene Gordon, Potomac Edison, told the group that while the plant was not particularly unconventional in design, the fuel and water supply and chosen site were distinctive. Scant condensing water dictated a cooling tower in order to derive the benefit of relatively cheap coal trucked in from a 500-million ton area, he said. Thus access to fuel overrode access to water and load in the site chosen on the Cheat River, he stated.

Necessity for Tower . . . Flow of the Cheat River is often as low as 100 sec-ft, hardly enough for the 60-Mw unit, Gordon pointed out. Consequently, he said, a 136,000 gpm cooling tower was installed to lower the temperature of the water from the dammed pool adjoining the station. The tower is designed to meet 80% of the requirements for 300 Mw.

Details of the boilers and turbogenerators were described by C. F. Hawley, Riley Stoker Co, and D. J. McLaughlin, General Electric Co. Plant's first unit, they said, was in operation 18 months from the date of the beginning of excavation and only three weeks from the time training began for the newly assembled operating staff. The plant, running at 150 Mw, is operated by 42 men.

Early Troubles . . . Start-up and early operating troubles of Albright Station were described by C. B. Withers, plant manager, as being a bit other than typical. Following are some of the difficulties he discussed.

1. Stainless steel burner tips came unwelded and were replaced by burners entirely of stainless steel. Carryover at the outset later disappeared, probably a result of self-washing.

2. Wet coal froze at the pulverizer in cold weather and this was relieved

(*Continued on page* 172)

THERE ARE NO CHIMNEYS on these houses. None are needed because they are all-electric even to house heating

To Cope with House Heating Load Local Study Is Essential

Atlantic City Electric finds load peaking in early morning, most of energy usage at night

JOHN B. TAYLOR and **T. B. KNOX,** Atlantic City Electric Co
E. B. WEBB, Radiant Glass Heat of South Jersey, Inc

Diversity factor low, demand factor fairly high, elimination of the usual sharp peak of cooking load, and overcapacity in distribution transformers. These were among the findings of a study of electric house heating by the Atlantic City Electric Co.

Opportunity for the study was provided by 20 all-electric homes served by one feeder in Northfield, N. J. The homes, occupied by middle-income families, are of one-story frame construction, and range in size from 5,825 to 7,100 cu ft, except for one which is 9,100 cu ft. All are equipped with storm sash and doors and are well insulated, 4 in. of rock wool in the ceilings, 2-layer aluminum foil insulation in the walls and 4-layer in the floor. They are heated by radiant glass panels, averaging 6.6 kw per house for a total of 132 kw. Other load, ranges, water heaters, lighting, and miscellaneous, brought the total connected to 398 kw at the time of the study which began Jan. 31, 1952, and continued through May, 1952.

The Tests . . . For the tests a recording ammeter and a totalizing wattmeter were installed on the feeder serving the 20 homes. Each of five test houses had a combination watthour and demand meter to register total use and a watthour meter and a 15-minute recording demand meter

to measure the heating load only. The test houses were all of 5,825 cu ft volume with 5.6 kw of heating. Additionally, a combination watthour and demand meter was installed to measure total use in each of two groups of these houses.

It was evident from the data collected that the heating requirement varied with the difference between inside and outside temperatures, lagging the temperature changes somewhat. Consequently, there was practically no diversity of demand between houses. The consonance of temperature changes and heating requirements appears in an accompanying graph. As part of the heat in the house is provided by energy used in cooking, water heating, lighting, etc, the general pattern of the heating unit load may be expected to approximate the daily load curve shown here, which was calculated from the 5-house tests. This curve shows that most of the energy for heating is used at night.

Morning Peak . . . With a very few exceptions the daily peak demand of the 20 houses occurred between 7 and 8 AM, but the highest demand of the heating units came about two hours earlier. The maximum demand for heating alone was 88 kw at 6 AM on Feb. 15. Against 132 kw of connected heating load, this is a demand factor of 66.7%. During the critical 5 to 6 PM period of this same day, the heating demand was 38 kw resulting in a demand factor of 28.8%. At this time the demand of the non-heating load was 27 kw and its demand factor thus about 10%.

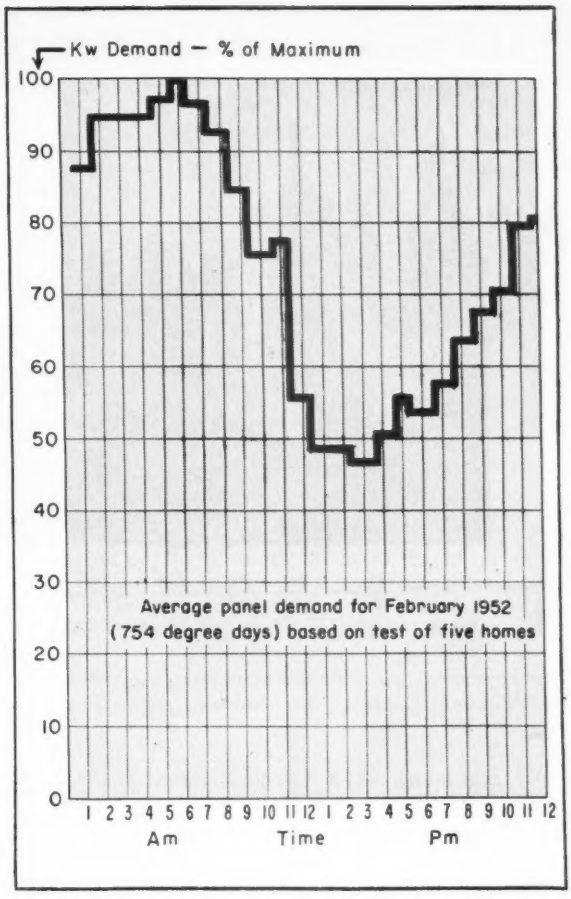
It is to be noted that during the test the thermostat settings remained fixed, were not turned down at night. If they had been, a high demand between 7 and 8 AM when they were turned up would have been expected.

For the first 12 months of complete occupancy of the 20 homes in the study, the energy consumption was 277,601 kwhr and the maximum demand 114 kw, for an annual load factor of 27.8%. In a later 12-month period these 20 houses plus 2 more used 341,903 kwhr and the highest demand was 120 kw—an annual load factor of 32.5%.

The characteristic early evening peak, which would be expected for a group of houses all having electric ranges, does not appear in the data of the test. The heating load absorbs it entirely.

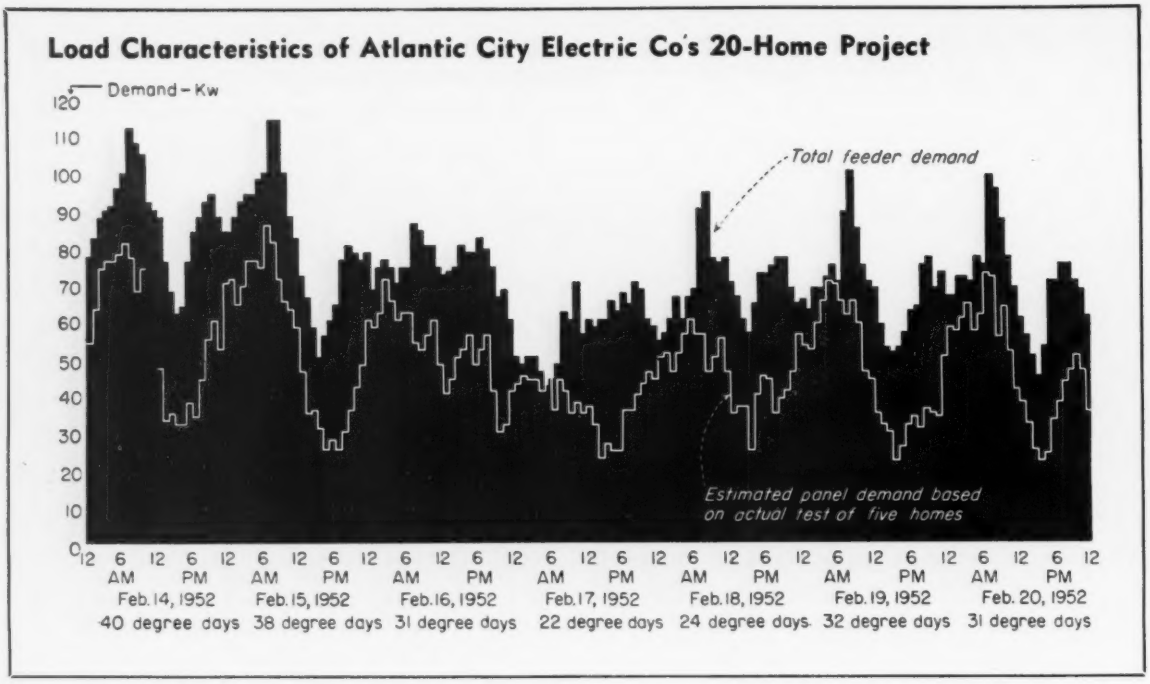
Demand Factor High . . . In the accompanying tabulated data of the 5-house test, two things stand out, demand factor and heat factor. The former goes up to 125% in two of the houses and in all except No. 5 is frequently above 100%. The causes of this are assumed to be twofold—the temperature coefficient of resistance of aluminum, which is the conducting metal on the glass panels, and the 15-minute demand period. Starting up, the aluminum grid on the panel takes more current than at the operating temperature of around 300 dg F at which the panel is rated. As the panel gets warmer the current drops rapidly. The shorter the demand period, the more apparent is this phenomenon.

The heat factor (kwhr per degree day per 1,000 cu ft) data show large variation, from a high of 0.474 in house No. 1 to a low of 0.004 in house No. 5. Since all 5 of the houses presumably have equal thermal insulation and weather exposure, this large variation must be ascribed to conditions of occupancy. It is very probable, for in-



EARLY MORNING PEAK and greatest energy usage after 10 PM are characteristic of electric heating load with fixed thermostat settings which avoid warming up after a cold night

REPRESENTATIVE TWO-BEDROOM HOUSE in 20-house all-electric project at Northfield, N. J., is served by Atlantic City Electric Co


Load Characteristics of Atlantic City Electric Co's 20-Home Project
Demand – Kw
120
110
100
90
80
70
60
50
40
30
20
10
0
Total feeder demand
Estimated panel demand based on actual test of five homes
12 6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12
AM PM AM PM AM PM AM PM AM PM AM PM AM PM
Feb. 14, 1952 Feb. 15, 1952 Feb. 16, 1952 Feb. 17, 1952 Feb. 18, 1952 Feb. 19, 1952 Feb. 20, 1952
40 degree days 38 degree days 31 degree days 22 degree days 24 degree days 32 degree days 31 degree days

HEATING LOAD of 20 houses, calculated from tests made on five of them, is paralleled with total load measured on feeders

stance, that house No. 5 was not occupied in the week of March 17 to 24 and no heat was used. This is the only explanation for the heat factor of 0.004. The range of heat factors in this test emphasizes the importance of judgment in the use of this factor as an element in estimating energy use for house heating.

Transformer Capacity . . . The distribution transformer capacity initially installed for the 20 homes was 200 kw, about 50% of the connected load of 398 kw. The tests showed that the capacity could have been reduced to around 25% of the connected load without danger to the transformers which are capable of handling loads considerably above rating during cold weather.

The data of these tests must be regarded as indicative of the load characteristics of house heating with radiant glass panels. They do not permit the drawing of any generally applicable conclusions. Instead, rather, they say that the characteristics of the load as determinants of system demand responsibility should be the subject of research and study in the local frame of climate, living habits, and income brackets.

Electric Radiant Glass Heating at Oak Park Manor, Northfield, N. J.
1951-52 Heating Season

Weekly Test Periods	Degree Days	House 1				House 2				House 3				House 4				House 5			
		Kwhr for Heating	Maximum Demand	Heat Factor	Demand Factor %	Kwhr for Heating	Maximum Demand	Heat Factor	Demand Factor %	Kwhr for Heating	Maximum Demand	Heat Factor	Demand Factor %	Kwhr for Heating	Maximum Demand	Heat Factor	Demand Factor %	Kwhr for Heating	Maximum Demand	Heat Factor	Demand Factor %
1-31 to 2- 7	170	380	6.8	0.383	122	315	6.8	0.317	104	255	5.9	0.257	105	230	7.0	0.232	125	190	4.2	0.191	75
2- 7 to 2-14	215	445	6.6	0.353	118	350	4.3	0.278	77	370	6.5	0.295	116	290	6.4	0.232	114	235	5.4	0.187	97
2-14 to 2-21	204	477	5.8	0.400	104	366	6.0	0.308	107	462	5.3	0.388	95	292	6.4	0.244	114	268	4.9	0.225	88
2-21 to 2-28	218	491	7.0	0.385	125	355	5.9	0.278	105	384	5.5	0.301	98	311	6.7	0.244	120	242	4.4	0.191	79
2-28 to 3- 6	211	494	6.7	0.400	120	362	5.0	0.295	89	319	6.4	0.259	114	317	6.1	0.259	108	287	5.4	0.233	97
3- 6 to 3-13	191	430	6.4	0.381	114	284	4.7	0.255	84	264	6.2	0.237	111	282	6.6	0.250	118	231	4.3	0.205	77
3-13 to 3-20	201	411	6.7	0.351	120	296	5.4	0.252	96	279	6.6	0.238	118	275	6.5	0.234	116	207	4.1	0.184	73
3-20 to 3-27	149	290	6.2	0.336	111	200	5.2	0.232	93	334	6.9	0.387	123	186	5.4	0.216	96	139	3.6	0.161	64
3-27 to 4- 3	138	242	6.0	0.301	107	181	4.2	0.225	75	334	5.8	0.415	104	133	4.8	0.166	86	85	3.4	0.106	61
4- 3 to 4-10	121	251	5.4	0.356	96	191	4.8	0.271	85	303	5.4	0.430	96	159	4.8	0.216	86	110	3.5	0.156	63
4-10 to 4-17	117	224	6.0	0.328	107	168	4.7	0.247	84	242	5.4	0.355	96	121	5.0	0.178	89	75	4.1	0.110	73
4-17 to 4-24	43	48	3.7	0.192	66	37	4.6	0.148	82	40	4.3	0.160	77	21	3.6	0.084	64	1	2.5	0.004	45
4-24 to 5- 1	88	243	5.0	0.474	89	194	4.5	0.378	80	267	6.6	0.520	118	159	4.6	0.310	82	81	3.6	0.158	64
5- 1 to 5- 8	60	110	3.6	0.315	64	73	3.5	0.209	62	88	4.7	0.252	84	23	4.2	0.066	75	18	2.6	0.052	46
5- 8 to 5-15	50	94	3.6	0.322	64	73	6.1	0.251	109	61	5.2	0.209	93	37	3.6	0.127	64	6	.84	0.026	15
5-15 to 5-22	46	86	3.6	0.321	64	42	3.1	0.157	55	79	4.6	0.295	82	45	3.4	0.168	61	13	3.5	0.048	62
5-22 to 5-29	16	29	3.8	0.311	68	36	3.4	0.386	61	35	4.3	0.376	77	15	2.4	0.161	43	1	1.8	0.017	32
1-31 to 5-29	2237	4745		0.364		3513		0.270		4116		0.315		2889		0.222		2189		0.168	

Heat Factor — Kwhr 1000 cu ft deg day
Demand Factor — Maximum weekly demand ÷ connected load

Farm Family Likes Electric Heating

Costs more but is worth it. Service outage fails to dampen satisfaction

JACK MYERS, Electrical Consultant for Eastern Nebraska Public Power District, Syracuse, Neb.

Actual cost of electricity to heat the W. J. Barr farm home near Liberty, Neb., through the seven months, October, 1952-May, 1953, was $221.21. The estimate had been slightly less, $210.58. Agreement between estimate and actual would have been even closer had it not been for a ground on the system which was discovered and removed after the first month's operation. The ground was caused by a wire that was scraped while being pulled into the conduit. Estimated and actual energy consumptions and bills by months appear in the table.

Paid Regular Rate for House Heating Energy . . . The Barr home is typical of the prosperous Nebraska farm, well-built, insulated throughout, and with storm windows and doors. The Barrs became interested in electric heating because of its convenience and cleanliness. They also wished to avoid the chore and bother of fuel heating. On the basis of an estimate from the Standard Sales & Distributing Co, Omaha, they approached their energy supplier, Eastern Nebraska Public Power District, hoping to obtain a special rate. In this they were disappointed, but they went ahead on the regular rate, 2¢ per kwhr for monthly use over 200 kwhr.

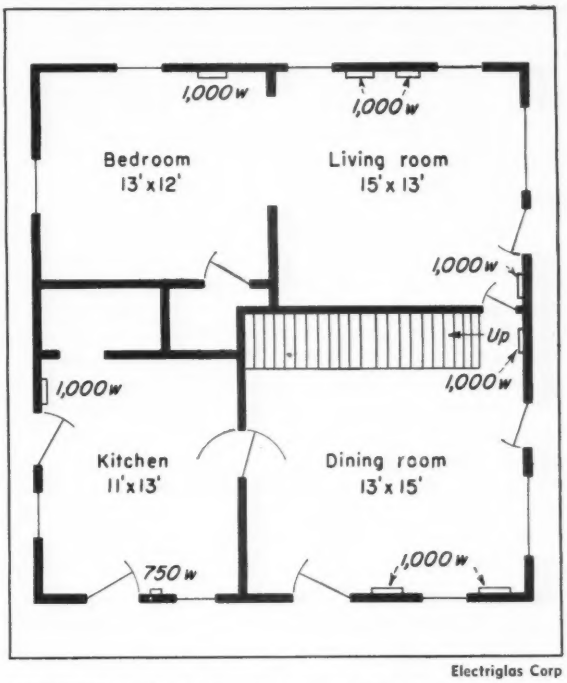
The floor plan of the house shows locations of nine heating panels on the first floor. The upper floor has only one panel in the bathroom, none in the four bedrooms. Total connected heating load is 9.5 kw, eight panels of 1,000 w and two of 750.

Inside Temperatures Ranged From 66 to 68 F . . . The panels are controlled by "blind" thermostats, no figures on them, only "high" and "low" at ends of the scale. According to the test thermometers, inside temperatures ranged from 66 to 68 deg F. Thermostats were not set down at night. The 2¢ rate applied to energy used for heating as the Barr's previous monthly consumption varied from 250 to 400 kwhr.

Some Data Not Accurate . . . For the seven months of the test, the energy requirement averaged 2.03 kwhr per degree day. The estimated requirement was 1.77 kwhr. Comparison of these figures is subject to question because of difficulty with the thermometer that was installed to record the outdoor temperature. Sometimes it worked; sometimes it did not.

A snow and ice storm in November interrupted service to the Barr home for 94 hours. This was uncomfortable, but according to Mrs Barr, they were no worse off than their neighbors who had stokers or other automatic heating equipment powered by electricity.

WINTER HEATING by electricity of this Nebraska farm home cost only $221.21. Its occupants, and owners were satisfied



Electriglas Corp

LOCATIONS of nine heating panels on the first floor of Barr home are shown in diagrams. There was only one panel on the second floor

Comparison of Estimated and Actual Performance

Month	Est Degree Days	Actual Degree Days	Est Kwh Consump	Actual Kwh Consump (1)	Est Cost	Actual Cost (2)
October	342	308.5	575	877	$14.47	$17.54
November	744	748.5	1320	1407	27.46	28.14
December	1169	1188.5	2075	2452	41.47	49.04
January	1280	1151.0	2268	2168	45.41	43.36
February	1088	798.5	1928	1909	38.50	38.18
March	810	713.0	1438	1239	28.73	24.79
April	410	547.5	726	1008	14.54	20.16
Total	**5825**	**5446.5**	**10330**	**11060**	**$210.58**	**$221.21**

Cleveland Utility Reports Experience With Electric Panel Heating

Study reveals load characteristics and consumption factors to aid in developing engineering standards and cost of serving panel heating customers. Report covers 10 week test of 32 homes

Conclusions to be drawn from analysis of 32 electric panel heating installations on the system of Cleveland Electric Illuminating Co over a 10-week period from January to April 1952 include the following:

1 Kilowatthours per M cu ft per degree day for houses studied ranged from 0.41 to 0.17.

2 Calculated range of annual use was from a low of 6,100 kwhr for a 3,300-cu ft house to a high of 16,000 kwhr for an 8,600-cu ft house.

3 Houses without storm doors and windows and with uninsulated floors had about 50% higher consumption than those completely insulated.

4 Raising the thermostat setting one degree had the same effect as if outside temperature dropped one degree.

5 Maximum demand expressed as a percent of capacity varied inversely as the outside temperature. The plot of demand with temperature followed a straight line relationship.

6 Demand at design conditions (—5 F) as determined by extrapolation of available data appeared to be on the average about 20% below maximum installed capacity.

7 No correlation could be found between wind velocity and maximum demand.

8 Although time, temperature, and thermostat setting and living conditions affect the load curve, the predominate factor was time.

9 There is not much diversity among heating load customers.

10 Based on limited data it appears that panel heating improves the individual customer's total monthly load factor during the heating season.

11 Individual monthly load factor during the heating season for the panel heating load ranged from 20 to 65% with the average of the individual monthly load factors 38%.

12 Load factor and use characteristics differed from the results secured in other cities in the same general area. But results correlated more closely with other cities near large bodies of water. Apparently the effect of water on Cleveland area weather is responsible.

Scope of the Study . . . The 32 homes used in this study included large (over 5,000 cu ft) and small (under 5,000 cu ft) units but did not include those that had misapplications of panel heating as the aim was to reflect normal expectations of sound application.

All homes were insulated. An "above average insulation" home had all walls and floors insulated and had complete storm doors and windows throughout. If a house lacked any of these requisites, it was classified as "blow average insulation."

Graphic recording demand meters were used both to measure the heating load independently and, where possible, to measure the total house load. These meters were of the integrating demand-type which record demand for 30-minute clock periods.

A summary of the results are shown in Table I. Descriptive data on individual homes metered are included in Table II.

Effects of Temperature and Insulation . . . Degree days was chosen as the independent variable because it was the most convenient index of temperature and weather data were readily available in that form.

Cleveland's average annual heating season contains about 6,000 deg days. Applying this to the average size home of 6,350 cu ft and the average consumption of 0.28 kwhr per 1,000 cu ft per deg day resulted in an average annual use of about 10,500 kwhr for panel heating. The calculated range of annual use was from a low of 6,100 kwhr for a 3,300 cu ft house to a high of 16,000 kwhr for an 8,600 cu ft house.

Factors Controlling Maximum Demand . . . Use of maximum demand as a percent of capacity eliminated variations in the size of customer, which varied from 5.65 to 13 panels. It also minimized the differences in insulation.

Data were available for temperatures extending only as low as 5F. By extrapolation it was found that the temperature at which demand would reach rated capacity of heating units was about —30 F. Demand at —5 F (design conditions) was about 20% below maximum installed capacity.

The reason for this is reserve heating capacity, some of which may be considered as excess capacity. The panel heating requirements of a home are often designed with a built-in safety factor of surplus capacity to insure quick response or recovery to thermostat settings. Some additional excess capacity may come about by the customer putting in a full-size 1,000-watt panel in each major room, although the size of the room may warrant only a 450- or 600-watt panel since the large panel will cost only about 30% more and have about twice the capacity.

No correlation could be found between wind velocity and maximum demand. The absence of correlation does not necessarily mean that the wind has no effect on maximum demand, but rather indicates that other compensating variables override the wind's effect. These allied weather factors are the direction, time and duration of the wind, the degree of sunlight, the amount of snow, etc., and the fact that all these items may vary locally.

Daily Load Characteristics . . . Group characteristics and daily load curves of individual customers show three major factors controling shape of the load curve:

Time—Daily coincident maximum demand occurred between 6 and 8 AM, but individual maximum demand occurred between 5 and 8 AM. A second daily peak between 7 and 9 PM averaged 70 to 90% of morning peak.

Temperature — Outside temperature determined size of the daily peaks. The load curve generally followed the outside temperature, lagging it several hours, but morning and evening peaks were still superposed on the curve as it followed temperature variations.

Thermostat Settings—Maximum demand of customers who kept thermostat settings constant was about 10 to 20% lower than those who cut them back at night.

Diversity . . . There is not much diversity among heating load customers. On the coldest days full group diversity is reached with about ten customers. Coincidence factor was only 90%. Although group coincidence factor is high, there is also some diversity between heating customers and other customer classes.

Most of the survey homes were all-electric. Total load curve for these customers was essentially the same shape as that of the panel heating load except that the peaks were broadened. Load characteristics, such as annual load factor and diversity, of the total load of a panel heating customer are essentially the same as those of the panel heating load itself.

Individual monthly load factor during the heating season ranged from 20 to 65% with an average of the individual monthly load factors of 38%. Annual load factor for individual customers ranged from 16 to 30% with an individual average of 20%. These individual load factors compared favorably with corresponding load factors of all electric homes without panel heating. But the annual group load factor of approximately 25% for the panel-heated houses is considerably lower than the group load factor for all-electric homes without panels.

Close study of the tables will reveal much data of value and interest to the house heating engineer.

Table I—Summary of Panel Heating Characteristics—1951–52 Season

Cust. No.	Volume Heated Cu ft	Max Demand Actual	Max Demand As % of Capacity	Kwhr per Deg Day per M Cu ft	Avg Monthly Load Factor Heating Season	Annual Load Factor
A-1 Small Homes—Below Average Insulation						
12	4860	6.7	95.7	0.33	28.5	17.0
17	3256	4.8	85.0	0.31	27.2	15.3
18	4245	4.2	74.3	0.33	41.4	23.4
22	4930	5.3	79.6	0.41	56.0	26.7
Group	**4320**	**5.3**	**83.7**	**0.35**	**38.3**	**20.6**
A-2 Large Homes—Below Average Insulation						
1	5502	6.4	91.4	0.25	27.8	15.2
3	5649	8.0	88.9	0.34	35.4	16.9
9	8560	7.6	76.0	0.31	44.8	24.4
14	6158	5.8	72.5	0.35	36.2	26.5
15	6700	6.5	72.2	0.31	33.3	22.3
24	7978	8.5	102.4	0.31	43.4	20.8
25	6608	10.3	103.0	0.38	35.8	17.2
28	6988	5.7	63.0	0.29	45.6	25.1
31	5292	6.3	79.0	0.34	34.5	20.1
32	6298	5.2	65.0	0.28	50.2	23.7
Group	**6575**	**7.0**	**81.3**	**0.31**	**38.7**	**21.2**
B-2 Large Homes—Above Average Insulation						
2	8592	6.5	72.2	0.17	36.3	15.6
7	6030	6.2	77.5	0.25	36.9	17.0
8	6503	4.8	68.6	0.25	45.3	24.2
10	6510	5.4	67.5	0.22	36.5	18.9
13	6936	4.9	70.0	0.20	37.6	20.5
26	7488	8.0	100.0	0.22	27.1	14.6
30	8250	9.0	78.0	0.20	27.0	13.3
Group	**7190**	**6.4**	**76.3**	**0.21**	**35.2**	**17.7**
Overall Average	**6350**	**6.5**	**80.0**	**0.28**	**38.1**	**19.6**

Table II—Descriptive Data on Homes Metered

Cust. No.	Volume Heated Cu ft	Kwhr per Deg Day	Insulation Walls & Ceiling	Insulation Floor	Windows & Doors No.	Windows & Doors No. with Storm Sash	Crawl Space	Thermostat Setting Day & Night
Group A-1 Small—Below Avg. Insulation								
12	4860	1.61	4 in. I	—	11	11	24 in.	68—68
17	3256	1.04	4 in. I	—	11	8	36 in.	70—60
18	4245	1.39	4 in. I	—	16	16	16 in.	72—72
22	4930	2.00	4 in. I	—	13	13	B	72—72
Group A-2 Large—Below Avg. Insulation								
1	5502	1.37	4 in. I	—	12	12	B	72—68
3	5649	1.91	4 in. I	—	18	16	30 in.	72—65
9	8560	2.62	A	—	22	20	B	72—68
14	6158	2.17	4 in. I	—	15	15	24 in.	70—70
24	7978	2.50	4 in. I	—	34	2	B	68—58
25	6608	2.52	4 in. I	—	21	15	24 in.	74—50
28	6988	2.02	4 in. I	—	14	14	B	65—60
31	5292	1.79	3 in. R	—	12	12	24 in.	75—70
32	6299	1.75	4 in. I	—	12	12	24 in.	70—70
Group B-2 Large—Above Avg. Insulation								
2	8592	1.45	4 in. I	A	13	13	B	72—65
7	6030	1.49	4 in. I	A	10	9	30 in.	70—70
8	6503	1.64	A	A	12	12	30 in.	65—65
10	6510	1.44	4 in. I	A	14	14	24 in.	75—75
13	6936	1.42	4 in. I&A	A	13	13	30 in.	72—70
26	7488	1.65	4 in. I&A	A	13	13	30 in.	72—70
30	8250	1.69	2 in. R	4 in. S	15	14	48 in.	69—55

Key: A = Aluminum Foil I = Insulwool R = Rockwool S = Spunglass
B = Basement.

House Heating Seems a Desirable

Home used in panel heating test was built some time ago . . .

This was remodeled when electric heating was installed

Illinois tests show peak responsibility of heating load and added investment to be small

VIRGIL R. BEERY, Radiant Glass Distributors, Springfield, Ill.

Load factors between 30 and 40% can be computed for electric house heating in rural areas if the incremental demand of the heating load at time of system peak is used as the base for calculation. This is not an unreasonable procedure because the contribution of a given load to the system peak is a large determinant of the cost to serve that particular load.

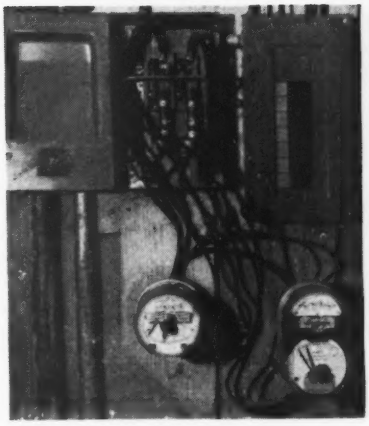
Farms Served by Co-ops . . . Demand and energy-use data were obtained in the winter of 1952-53 from 11 central Illinois farm and rural homes heated by glass panels. Shelby Electric Cooperative serves two of the homes; the other nine are connected, one each, on the lines of Clay Electrical Cooperative, Inc; Illinois Rural Electric Co; Wayne White County Electric Cooperative; Clinton County Electric Cooperative, Inc; Adams Electric Cooperative; Southwestern Electric Cooperative, Inc; Coles-Moultrie Electric Cooperative; Springfield Municipal System; Central Illinois Public Service Co.

These suppliers furnished and installed watthour meters with 15-minute demand registers, two in each home, one on the total load and the other on all except the heating panels.

All of the houses are well insulated, rock wool in ceilings and walls, foil under the floors, storm windows all around. Three are new, two remodeled, and the rest of varying age. Heating indexes of the group (kwhr per degree-day per 1,000 cu ft) vary from 0.22 to 0.33. The annual degree-day range in the area is from 4,600 to 5,500.

Demand Records . . . Occupants of the homes read the demands on the meters twice daily, at 4 PM when the hands were set back and at 7 PM without setting hands back. Thus two demand

Load for Farm Lines



TOTAL LOAD is measured on one meter, non-heating load on the other to obtain test data

records were made, for 24 hours and for the system peak period from 4 to 7 PM.

It was the idea of this set-up that the difference between total and non-panel demands could be taken as the heating demand. This difference, of course, is not the actual heating demand but is the incremental demand added into the total by the heating load. And on this increment depends any additional cost to serve resulting from the heating load.

The differences between readings of the two watthour registers were an accurate record of electricity used for heating in each home.

The tests began in December and continued through April, including the winter's coldest weather. The highest demand data can thus be taken as maximums for the season and energy uses can be extended proportionately to degree-day records to cover the full year. On this basis, Table I was compiled.

Not Coincident, But . . . The total load and non-heating load demands in Table I cannot be taken as coincident although they may be in some cases. But the difference between them, whether they are coincident or not, represents the additional distribution capacity requirement of the heating load. This is another way of saying that the investment cost responsibility of a given load is not to be determined on the characteristics of that load taken by themselves but on those characteristics in relation to those of other loads that combine with the given load into a total.

Just as the distribution capacity requirement, or peak responsibility, of electric heating service can be arrived at as the difference between total and non-heating peak demands recorded in 24 hours, so can its generation and transmission requirement be taken as the difference between those demands as recorded in the system peak period of the day.

Off-Peak Control . . . Unfortunately, competent data on demands in the hours 4 to 7 PM were obtained from only three of the 11 houses in the test. They appear in Table II. These data are not sufficient to justify any positive statement, but they do indicate that the generation and transmission peak responsibility of electric house heating is not so large as would seem at first glance. In this connection it is pertinent to observe that with panel heating it is possible to reduce this responsibility to one fourth or even to zero by use of time control. Tests have shown that panels can be operated at half voltage or even cut off entirely for a considerable period without discomfort to occupants of a house.

Rural Service Adaptable For Heating . . . It is to be kept in mind that the data here presented came from installations in farm and rural homes. In service to such homes the distribution system picture is quite different from what it is in urban service. In general, there are no long secondary runs, and a transformer for each customer is the rule. The matter of additional distribution capacity for house heating becomes almost an academic consideration. A transformer large enough to handle the summer load of farmstead and home will have more than ample overload capacity to carry the heating load in winter. And the requirement of the heating load in respect to generation and transmission capacity can be minimized by time control. Thus electric house heating is a most desirable load on rural lines, a load that offers a large increase in energy usage with small additional investment necessary to serve it.

Table I—Incremental Heating Demands and Load Factors Derived from Them

House	Total Load Demand-Kw	Non-Heating Load Demand-Kw	Heating Load Increment-Kw	Est. Annual Heating Kwhr	Annual Load Factor %
1	9.2	5.1	4.1	11,000	30.6
2	14.0	5.6	8.4	16,000	21.7
3	9.4	4.7	4.7	12,000	29.2
4	14.6	8.0	6.6	18,000	31.1
5	12.0	5.6	6.4	8,500	15.3
6	12.6	5.6	7.0	13,000	21.2
7	15.0	5.0	10.0	20,000	22.8
8	10.0	4.0	6.0	10,800	20.5
9	10.0	5.0	5.0	13,800	31.5
10	11.0	4.7	6.3	13,300	24.1
11	14.0	5.0	9.0	19,000	24.1
Averages	**11.98**	**5.3**	**6.68**	**14,127**	**24.2**

Table II—House Heating Incremental Demands and Load Factors—4 to 7 PM

House	Total Load Demand-Kw	Non-Heating Load Demand-Kw	Heating Load Increment-Kw	Est. Annual Heating Kwhr	Annual Load Factor %
1	8.2	4.4	3.8	11,000	33.0
6	8.8	4.2	4.6	13,000	32.2
10	8.1	3.7	4.4	13,300	34.5
Averages	**8.37**	**4.1**	**4.27**	**12,433**	**33.3**

Controlling the House Heating Load

Most installations today do not reach maximum benefits obtainable through control of demand and refinement of regulating methods. Here's how they can do so

W. F. FRIEND,
Mechanical Engineer, Ebasco Services, Inc., New York, N. Y.

Among characteristics of electricity favorable to its use for house heating are its simplicity of application to a variety of heating system types and its adaptability to automatic control. The heat input can not only be regulated to maintain desired temperature. But the controls may also provide features for reducing peak demand from heating load imposed on distribution facilities and elsewhere within the utility system. Unfortunately, the majority of installations today do not achieve potential benefits obtainable through control of demand and refinement of regulating methods.

Weather-compensating types of control systems, used mainly in commercial and industrial buildings and institutions but also available for residential structures, are well established. The Buyers' Directory for heating equipment exposition held several months ago in Chicago listed 17 makers of such control. For buildings heated by steam, it has been the practice to change supply pressure or return-line vacuum in conformity with weather fluctuations. This practice proportions system heat input to heating requirements and provides benefits of modulation.

Condensation of paper presented at 1953 American Power Conference

Automatic Control Systems . . . Advances in control methods and devices through the past decade have yielded better sensitivity and stability, closer response to fluctuating load conditions, greater simplicity of calibration and initial adjustment, and lessened maintenance—along with falling prices and rising quality. For electric resistance-type installations we can expect further refinements with attention toward improvement of load characteristics. These will come once manufacturers become aware of the size of the market and receive sufficient information on performance characteristics desired by users, consultants, and utilities themselves.

The advances in automatic control technique have come about through application of the so-called "feedback" principle of regulation. This embodies four essential functions:

1. Measurement of the desired condition
2. Comparison with a standard
3. Application of correction
4. Check after correction

By making increments of correction or frequency of application progressively smaller, any desired degree of accuracy can be attained. With manual control, functions two, three, and four are performed by a human operator who then supplies the feedback link.

Automatic control systems may be classed under two broad headings:

1. *Open sequence*, in which one or more independently variable factors

Observations on Electric House Heating

- Electric heating should be confined to houses insulated with double windows or at least weather stripping.
- Seasonal consumption, expressed as heat factor (ie kwhr per degree day per 1,000 cu ft gross volume), seems to be between 0.3 and 0.4.
- Heat factors above 0.4 usually result from faulty insulation, severe exposure, or abnormal living habits.
- Heat factors less than 0.25 result from "incidental" living, utilization of only part of available space, or other unusual conditions.
- There is a tendency to size installations at or below design requirements, unlike with fuel-using systems, for which "reserve" capacity margins up to 30 or 40% have been added to assure rapid heating, quick recovery, and adequacy for extreme weather.
- Coincidence factor for many complete installations used for normal living come within the limits of 0.75 and 0.95; relationship of outdoor temperature to design factor affects the value.
- For groups of houses sized as to rated capacity of installation, annual load factor of heating load for a normal season can be expected to be below 20% on the basis of diversified demands and below 15% of non-coincident demands.
- Characteristics of heating load under present methods of design and operation are less favorable than of total other load of residential customers.

or quantities act to regulate the controlled variable or result.

2. *Closed system,* in which the controlled result is itself reflected back and becomes a component among the regulating factors.

An example of the open system is found in the hypothetical use of an outdoor thermostat to regulate power input to heating installation. As outdoor temperature falls, voltage applied to terminals of the resistors is increased, or the number of resistors placed in operation increases. The system requires calibration for specific conditions of each installation; if desired, several sets of conditions may be applied selectively.

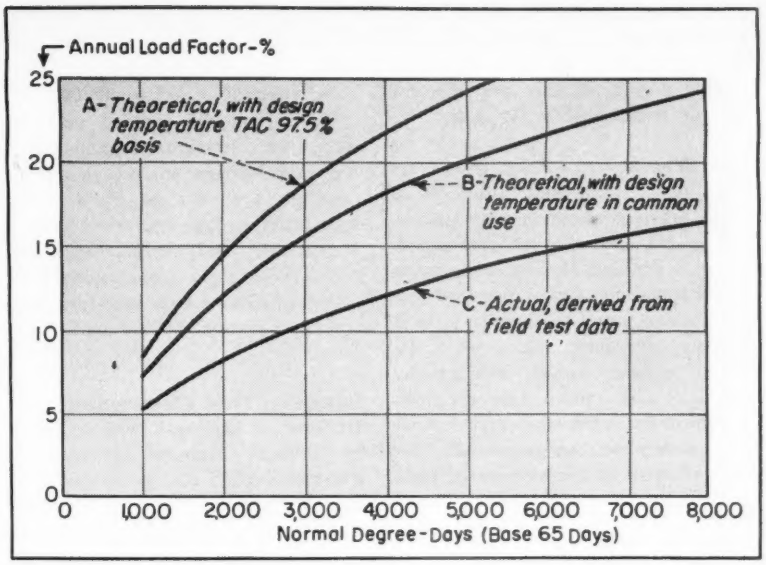
Essential feature of the open sequence system is that indoor temperature produced has no effect on action of the control nor does it serve as a correcting factor. Consequently, changes in sunshine or wind, or internal heat contributed by the lighting system and appliances will react and disturb indoor temperature.

Closed system or feed-back type overcomes such difficulties. It brings directly into effect the quantity to be controlled and thus creates independence from all disturbances. Moreover, it does not require calibration for each special condition or combination. Feed-back control, unlike open-sequence control, must nevertheless involve some error, since error brings about the correction. However, the error can usually be made small without undue complication.

An example of closed sequence control is obtained by changing location of the thermostat from outdoors to indoors. So long as the thermostat is unsatisfied, power is supplied to resistors. Resulting rise of indoor temperature affects the thermostat and cuts off the power when temperature becomes too high. Modulation is obtainable by varying amount of power supplied, in some proportion to degree of error existing.

Factors in Control . . . In choice of control principles and devices there are self-regulating factors inherent with all heating applications:

- Thermal storage or "flywheel" effect inherent in buildings; i.e., heat released by structural materials and contents, tending to retard fall of indoor temperature when voltage is reduced or power cut off.
- Heat contributed from concurrent electric consumption for lighting and appliances, when total load of residence is high.
- Benefit obtainable from adequate insulation of the structure, in reduction of amplitude and time rate of indoor temperature fluctuation.
- Infrequent occurrence and limited duration of extreme low temperatures, seasonally and daily.
- Reduction of power input to resistors, caused by distribution system voltage regulation and line drop which accompany peak demand.



LOAD FACTOR of house heating can be improved. Curve C shows load factors derived from test data of installations made on basis of "design temperature in common use." But because of inadequate structural insulation and more heating capacity than design requires, realized load factors are lower than theoretical ones of Curve B. Load factor can be bettered by calculating installations on ASHVE "TAC 97.5% Curve A," with design temperature of that value, shows it was equalled or exceeded 97.5% of December to March hours

Developing Control . . . In addition to simple voltage reduction by transfer of resistor units between 240 and 120 v on 3-wire service, there are other methods to achieve improvements in accuracy and uniformity of temperature control, in economy of energy consumption, and in reduction of peak demand. These include:

- Use of autotransformers to provide voltage at terminals continuously variable over a substantial range.
- Circuit arrangement for series-parallel switching of resistors.
- Programming device to shift power supply from one room to another, with or without bias of the timing schedule by means of an outdoor thermostat and/or by total load.
- Load regulation by carrier current from contral point or substation.

Some of these have been constructed experimentally or given limited field trial. They can provide modulating characteristics whereby heat delivered is regulated in conformity with outdoor temperature and sunshine.

Greater cost of improved equipment should not be a deterrent, considering potential savings through reduction of peak demand and benefits from better control of indoor temperature. Economies can be looked for with modern fabrication methods and mass production of such devices as autotransformers. For example, a manufacturer has indicated that cost of a 7.5-kva autotransformer for 240-186 v that is to provide 60% of normal heating capacity in addition to the 25% obtainable with line-to-neutral transfer, would be less than $50. Variable ratio features add to the cost.

Capacity Requirements . . . The direct, obvious, and economic method of "load limiting control" necessary with electric heat is to hold installed capacity at the minimum amount capable of giving satisfactory heating service, in two ways:

1. Provision of adequate thermal insulation and "tight" construction.

2. Avoidance of surplus capacity in heating units.

Because electricity is more expensive than fuel-generated heat, its use justifies greater outlay for insulation, double glazing, weather stripping, and careful workmanship.

Rate Schedules . . . Apart from automatic devices that limit load peaks of house heating, a large measure of control is exercised through rate schedules. A demand element is common where large amounts of low load factor business must be served. It is in a sense automatic, acting as a deterrent to excess capacity and a brake on careless operation. One specimen rate form for residential service stipulates a demand charge, say $2, for each kilowatt of excess metered peak demand in that month above a stated base of, say 7 or 5 kw. This is in addition to kwhr charge for energy consumed.

Another form, differently expressed, is: $1 first 15 kwhr or less per month; 3.5¢ per kwhr for next 35 kwhr; 2.5¢ per kwhr for next 150 kwhr (plus 200 kwhr for each kilowatt over 5); 2¢ per kwhr next 200 kwhr; and 1.5¢ per kwhr for excess over 400 kwhr.

The demand component in this case (resulting from added consumption in the third block due to large increments of load such as house heating that bring total demand above 5 kw) is equivalent to $2 per month per kw where consumption exceeds 400 kwhr monthly. There are other forms which give effect to poor diversity and low load factor character of heating load.

Load Characteristics . . . Many analyses of house heating load have been made by utilities and committees to provide a basis for establishing policy with respect to local promotion, or for adjusting rate levels or types appropriate to the load. Results have often been inconclusive, or inconsistent with findings elsewhere because of:

- Incomplete test metering facilities.
- Period of test too short or weather abnormal during test.
- Sampling of houses and heating system types non-representative.
- Uncertainties as to house construction and insulation.
- Lack of information on actual basis for heat loss calculation.
- Failure to record indoor temperatures and extent of night setback.
- Absence of information on type of automatic control used.
- Disregard of effect of heat obtained from electricity used for purposes other than heating.
- Disregard of solar effect.

To correct the lack of authentic data, a set of recommendations covering assembly and analysis of heating data has been drafted by a utility-industry committee concerned with research into load characteristics and rate applications. Conclusions from survey of data on resistance-type heating are shown on the first page of this article.

Improving Load Characteristics . . . Utilities are finding it wise to act in an advisory capacity to customers who contemplate electric heating. This may include estimates of operating expense, check of load calculations, advice on kilowatt and voltage rating of apparatus, and recommendations on house construction together with extent and kind of insulation and selection of type of controls.

One utility has established minimum standards with respect to insulation and controls. If these are complied with, it waives the demand charge in the rate for that load. Another company has issued a bulletin for customers and local contractors calling attention to requirements for insulation and minimum air infiltration and to use of manual cut-off switches and night setback features.

Load Factor and Demand . . . Because electricity cannot be stored, investment necessary to provide capacity for peak hour demands is a large and often dominant element in cost of service. House heating has an inherently low annual load factor—under 20% on diversified basis. Any progressive reduction of cost to customers will, accordingly, hinge largely upon developments which tend to improve load factor or the element known to engineers as "diversity" or "coincidence," and to laymen as "stagger."

Considering only the main categories of utility plant and facilities—generation, transmission, and distribution—the investment they represent is from $300 to $500 per kw of peak-carrying capability, on incremental basis. Assuming the lower figure, it is possible that with fixed or capital charges at 10% annually and coincidence taken into consideration, fixed charges alone amount to $17 per year per kw. A 20% annual load factor (diversified), this is equivalent to about 1¢ per kwhr.

If investment in a particular case comes near the upper value and capital charges amount to 15% annually, then charges may exceed $35 per kw-year. In addition, energy production expense commonly is 2 to 4 mills, and other costs (including outside-plant operation and maintenance) may run to a like figure. It is evident that in the fixed-charge component lies the chief opportunity for lowering cost of service. Moreover, in comparing heating methods and control types, the arbitrary assumption of power cost without investigation of local circumstances, cannot give trustworthy results.

Concerning cost of competing forms of heat, two comparisons may be cited. On per Btu-utilized basis, electricity at 2¢ per kwhr is 3 to 4 times as expensive as oil at 14¢ per gal, and it has 6 to 8 times the cost of natural gas at 50¢ per Mcf. Disparity is overcome mainly through intangible benefits derived from electric heating and by a favorable difference in cost for the owner's installation.

Thermal Storage . . . In principle, thermal storage has sound possibilities for reducing peak demand to handle extreme weather and normal variations in daily weather cycle. Experiments have been conducted for half a century, using many substances including rock, metals, natural soil, water, and other liquids. Many installations with water have been built some utilizing temperature upwards of 250 F and suitable pressure. However, cost and space requirements have been high.

At present a different approach is under investigation in projects concerned with electric heat pump systems and solar heating. Substances having considerable latent heat of crystallization, with melting and solidification occurring within the temperature range useful for house heating are being developed by chemical manufacturers and research laboratories. An example is disodium phosphate which crystallizes in one of its forms with 12 molecules of water.

Considerable literature on the principles of crystallization control and performance of experimental apparatus is available. While an economic design is not definitely in sight, results have been encouraging and research is being accelerated.

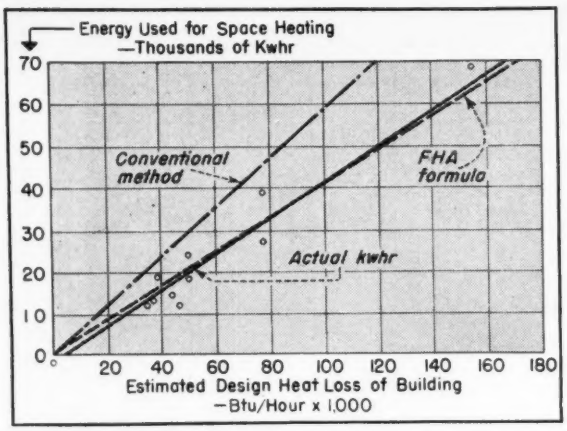


FIG 1—KILOWATT HOURS used for heating calculated by FHA formula agree closely with actual values. Older formula gives higher values

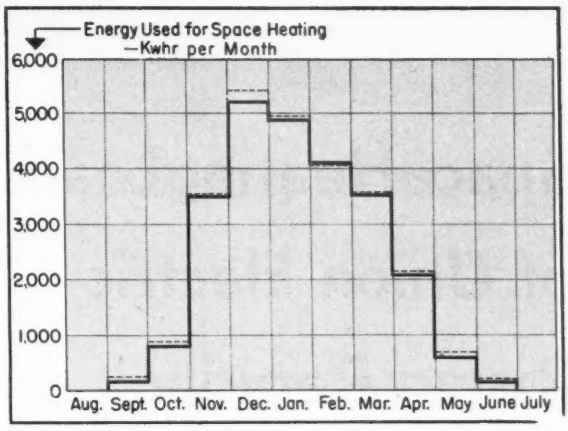


FIG 2—AVERAGE KILOWATT HOURS used per home in each month correspond closely with kilowatt hours estimated by using the FHA formula

FHA formula proves better for . . .

Electric Heating Calculations

Commonwealth Edison Co serves 25 houses heated solely by electricity. In ten of these watthour and demand meters were installed. Kilowatt hours and charted demands were obtained for both general service and for heating loads.

These homes varied in size, construction, and occupancy but fell into a pattern with respect to heating requirements. They are located in various parts of the Chicago area and are probably a good sampling of the type of homes served by the company.

Heat requirements were calculated using two different formulas. One formula is that in common use:

Fuel requirements per season = $\frac{Q \times 24 \times D}{T \times H \times E}$ where

Q = Btu loss per hour
D = Degree days per heating season
T = Design temperature difference
H = Heating value of the fuel
E = Efficiency of the heating system

The other formula is that prescribed by the Federal Housing Authority for estimating heating costs for electric heating and is:

$F = \frac{H \times D}{Td \times 200}$ where

F = estimated annual kilowatt hours for heating
H = calculated heat loss in Btu per hr under design conditions
D = Average recorded annual degree days
Td = Temperature difference in degrees F between inside and outside design temperatures

Calculated values derived from each formula are tabulated, with actual kilowatt hours used. Calculated and actual data are compared in Fig 1.

Average kilowatt hours used per home in each month are compared with the average estimated amount as determined by the FHA method, Formula 2, in Fig 2.

In each case it can be seen that the actual kilowatt hours used agrees very closely with the estimated figures obtained with the FHA formula.

Summary of Tests

	Range	Average
Volume, cu ft	5,880–28,050	12,664
Connected load, kw	7–42	16.4
Total Annual Use, kwhr	16,046–85,512	32,908
Heating, kwhr	12,620–67,774	25,070
Water heating, kwhr	1,115– 8,122	3,816
General Use, kwhr	2,309–11,061	4,022
Heating kwhr/kw	875– 3,000	1,520
Watts/cu ft	.9– 1.6	1.3
Kwhr/cu ft	1.1– 3.8	2.02
Kwhr/Btu/hr heat loss	.272– .510	.405
Kwhr/deg day/M cu ft	.17– .58	.30

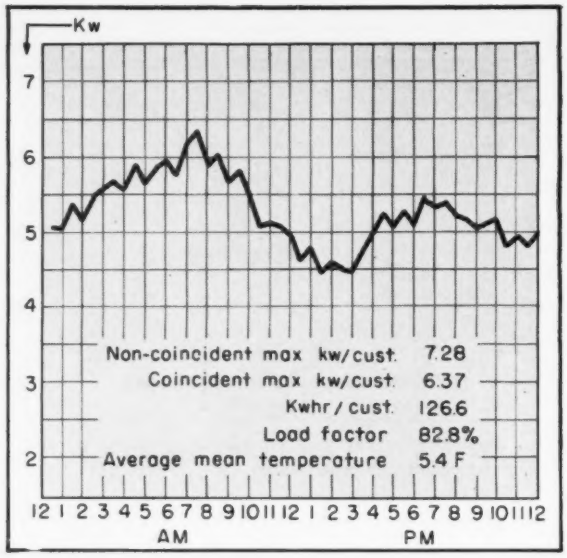
* Conventional Formula
** Method suggested by FHA

Comparison of Calculations

Volume Cu Ft	Htg Cap Kw	Heat Loss Btu/hr Computed	Kwhr *For. No. 1 Computed	Kwhr **For. No. 2 Computed	Kwhr Actual
5,880	7	37,500	21,800	15,500	13,647
10,370	15	48,300	28,000	19,900	13,133
28,050	42	154,900	92,000	64,000	67,774
11,230	10	35,900	21,000	14,800	12,620
10,300	13	77,400	45,000	32,200	39,441
11,370	10	52,000	30,000	21,500	23,890
9,150	12	38,000	22,000	15,700	19,004
10,000	11	46,400	26,700	19,000	14,724
22,000	31	78,000	45,200	32,200	27,561
8,300	13	52,000	30,000	21,500	18,861

SpaceHeatingLoad of Union Electric Rising Rapidly

Morning peak characterizes heating load. Data of these curves are average 30 minute demands of 7 installations



Daily average for coldest week

Electric space heating in the Union Electric service area has achieved a remarkable amount of customer acceptance in recent years. Latest figures indicate that there are 544 complete residential installations with a total connected load of 4,039 kw and 466 auxiliary residential installations with a total connected load of 973 kw.

At present the saturation of space heating, referred to our 468,002 residential customers (as of Aug. 31), is very small, amounting to only 1/9 of one per cent for complete and 1/10 of one per cent for auxiliary installations. Obviously the present effect of space heating on system loads and net revenues is minor.

It All Adds Up . . . If the rapid increase in number of installations continues, however, the effects will be more noticeable. For example, a 1% saturation, or 4,680 complete installations at the present average of 7.42 kw each, plus a 1½% saturation, or 7,020 auxiliary installations at 2.09 kw each would add a total of 49,400 kw of connected load to the system. The simultaneous space heating demand, using a 90% coincidence factor based on connected load, would be 44,500 kw, which, however, would not be coincident with either the winter system peak or the annual residential class peak.

At 20% annual load factor, based on coincident demand, some 78 million kwhr would be sold, equal to 7.6% of total 1952 residential kwhr sales. Our residential class sales have been increasing at the rate of about 12% per year. Thus, if the number of space heating installations increases to about 14 times the present value, the effect on the residential kilowatt hour sales would be equivalent to about one year's normal growth. Higher saturations than those assumed above will, of course, have a more marked effect on system loads and sales.

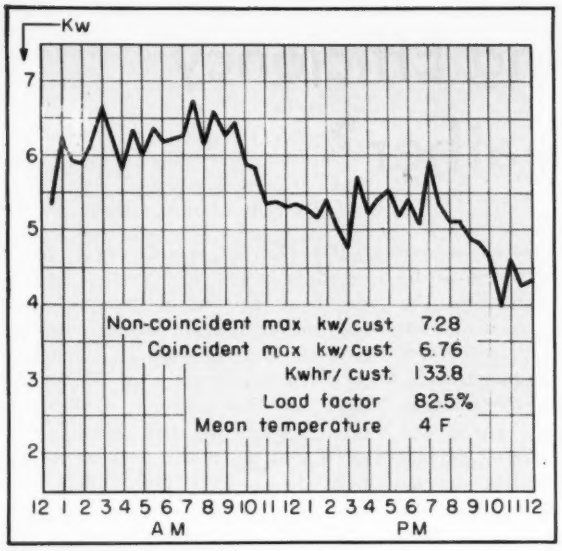
The electric heating installations of seven customers were metered through a full heating season, October 1950 through May 1951, using G9 recording demand meters and watthour meters. An effort was made to obtain houses of uniform size with adequate insulation. The houses chosen were four or five room, single family dwellings, varying from 5,768 to 9,607 cu ft of heated space. Three of the seven houses had basements. In each home the roof and walls were insulated, and in addition four houses had floor insulation. All structures except one had storm windows installed.

Connected load (nameplate) varied from 5.0 to 9.2 kw, averaging 7.46 kw per home, or about 1 kw for each 1,000 cu ft of heated space. ASH&VE heat loss calculations were made for each home, the average value being 30,960 Btu per hour per home, or roughly 4 Btu per hour per cu ft of heated space. Theoretical connected load on the basis of calculated heat loss would average 9.07 kw, some 22% higher than actual connected load. Test results indicate, however, that connected load values which are about 80% of theoretical prove entirely satisfactory.

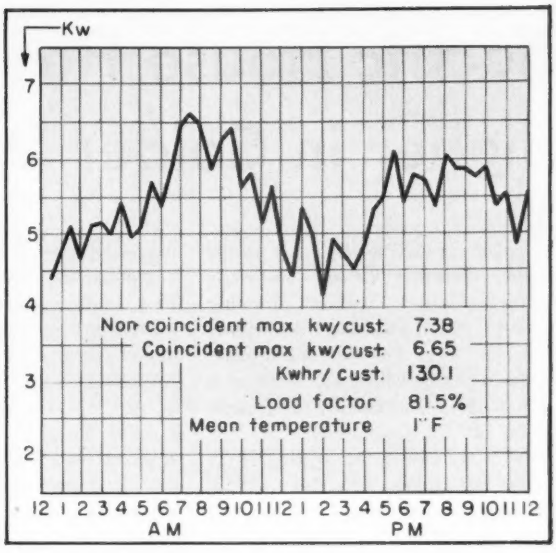
Average Annual Use Was 18,533 Kwhr . . . The average customer was metered during a period including 4,760 degree days, or almost 96% of the total of 4,970 for the heating season. Based on the energy use metered, the average customer's space heating use was 12,520 kwhr and is calculated to be 11,560 kwhr in a normal season of 4,587 degree days. Other use averaged 6,013 kwhr per year, and the total annual use of the average customer was 18,533 kwhr for the metered year and would be 17,573 kwhr in a normal degree year.

The heat factor (kwhr per degree day per 1,000 cu ft of heated space) varied from .25 to .46, the average of the seven homes being .33. The high value of .46 was measured on the home without storm sash. This house also had a large fireplace without damper, indicating the possibility that even when burning a fireplace draws more heat out of a house than it puts in.

The maximum coincident demand per customer, assumed to occur during the coldest week of the heating season, was 6.76 kw for the half-hour ending 7:30 AM on Tuesday, Jan. 30, 1951. This demand was 81.4% of



Day of maximum demand



Coldest day of heating season

the annual average non-coincident demand of 8.30 kw per customer and 90.6% of the average connected load (nameplate) of 7.46 kw. The maximum coincident demand on the coldest day of the season (mean temperature 1 deg F) was 6.65 kw at 7:30 AM.

The annual load factor of the seven customers varied from 11.4 to 22.2% for the metered season averaging 17.2% based on non-coincident maximum demand or 21.1% based on coincident maximum demand. For a normal year, comparable average load factors would be 16.0 and 19.6% respectively. Based on connected load (nameplate), annual load factor would be 17.7% in a normal year.

Daily load factors were about 73% based on non-coincident demand or about 82% based on coincident demand for the day of maximum demand, coldest day, and average weekday of the coldest week. Daily coincidence factors for the same days approached 90%.

Heating Cost Would Average $200 a Year . . . The estimated cost per customer for electric space heating, calculated at 1.75¢ per kwhr (the lowest step of the residential rate, applying to kwhr used in excess of 400 per month), would have varied from $135 to $325 for the 1950-51 heating season, averaging $220 per customer. For a normal year, the average cost per customer would be $200.

The number of customers included in this study is admittedly too small for statistically stable results. However, it does give some basic indication of the load characteristics of electric space heating. It is felt that the submetering of a larger group of customers would not materially change the factors developed.

Daily mean temperatures approached the design value of 0 deg F on several days. A comparison of calculated ASH&VE heat loss figures and actual Btu input for six of the seven customers appears in the accompanying table.

Installation Capacity Can Be Reduced . . . The table indicates that for a 0 deg F day design, the actual hourly heat required is about 70% of that shown by the ASH&VE calculations. It is possible that the constants given in the ASH&VE tables have a built-in factor of safety, or possibly the additional heat requirements are supplied by lighting and other electrical appliances. In either case, the practice of installing only about 80% of the theoretical capacity required seems to be warranted. An additional factor of safety is provided by the fact that the radiant panel installations show an actual 15 minute maximum demand about 10% above nameplate rating.

House Heating Data Gathered from Test Installations of Union Electric Co

Cust. No.	Maximum Kwhr/Day	Mean Temp.	Average Btu Input/Hour Actual	Average Btu Input/Hour Corr. to 70 Deg Diff.	Calc. A.S.H. & VE Heat Loss	Ratio: Actual to Calc.
B1	151.8	1 deg	21,600	21,900	30,028	.729
B2	111.9	1 deg	15,900	16,100	20,929	.769
B3	169.4	4 deg	24,100	25,600	40,880	.626
B4	124.0	4 deg	17,600	18,700	21,469	.871
B5	203.5	4 deg	28,900	30,700	45,985	.668
B8	98.7	1 deg	14,000	14,200	20,772	.684
Average	**143.2**		**20,400**	**21,200**	**30,010**	**.706**

Electric House Heating Efficiency Higher in Colder Weather?

Possibly it can be said that as the weather becomes colder, electricity is more efficiently utilized in house heating. This indication is derived from the data of the accompanying four charts which are part of a study of this load made by the Detroit Edison Co.

The study covers the heating of 29 homes, September, 1952-May, 1953. The homes range in size from 4 to 7 rooms. All are heated by radiant glass panels. Connected panel loads range from 3.2 to 18 kw and average 9.08 kw.

The winter of 1952-1953 was abnormally warm. The degree-days in the nine months of the study were 5,834 as against 6,538 normal for Detroit. Because of this and also because the installations studied vary so greatly in size and were not selected according to established sampling methods, it is not considered that the data obtained can be accepted as representative of the complete picture of electric house heating in Detroit.

Cost of House Heating

Average annual space heating use per customer was 11,412 kwhr for the period from Sept. 1, 1952 through May 31, 1953. Use for June, July, and August was excluded as few customers used their space heating units during these summer months. "Other" use of these customers averaged 3,148 kwhr annually. Total annual use per customer amounted to 14,560 kwhr, 78.4% of which was due to space heating.

At the low rate of 2.25¢, less 3% discount, per kwhr, the annual heating bill would amount to $250 per customer. Annual degree days for the 1952-53 heating season were 5,834; degree days for a normal heating season are 6,538. Because space heating use bears a direct relation to annual degree days, it is probable that energy use per customer in a normal season would be about 12,800 kwhr and the annual bill $280.

Demand data were available for the space heating load only. Coincident maximum demands for this load were computed for the coldest week of the past heating season, Jan. 5-9. The maximum coincident demand (30-minute) during the period was 4.77 kw, reached at 9 AM, on Wednesday, Jan. 7. As the minimum weekday temperature of the past heating season was reached during the morning of that day, it is probable that this was the maximum coincident demand for the heating season. The non-coincident maximum demand for the average of 29 customers was 7.18 kw, the average connected load 9.08 kw. It is probable that the average maximum demands, both coincident and non-coincident, would have been higher had the design temperature of −10 deg F (or an equivalent of 70 degree-days) been reached during the test period.

Based on data available from the past four surveys, it appears that the non-coincident maximum demand would be about 90% of the connected load and that a coincidence factor of near 80% should be expected with an outdoor temperature of −10 deg F. Thus for the average connected load of 9.1 kw, the coincident maximum demand would amount to about 6.6 kw at these lower temperatures. This figure is also approximated by projecting the maximum demand-degree day relationships arrived at for the 1952-53 heating season.

The annual load factor for the 1952-53 season, based on use of 11,412 kwhr per year and a coincident maximum demand of 4.77 kw, was 27.3%, and based on the non-coincident maximum demand of 7.18 kw, was 18.1%. Adjusted to a more normal season heating use of 12,800 kwhr and a coincident demand of 6.6 kw for the average of the 29 customers, the annual load factor would be about 22%.

Not a Normal Day

It will be noted that use and demand for the day of the system peak were abnormally low. The temperature at the time of the system peak, 6 PM, Dec. 23, was 45 deg F, compared to a ten year average of 29 deg F at the time of the maximum load on the system. Similarly degree days for Dec. 23 were 21, compared to a ten year average of 36 degree days. For this reason it is probable that "normal" use and demands for the day of the system peak would be from 50 to 75% higher than the figures shown on Chart 4.

Cost Considerations

While to date the sizes of the samples of house heating customers tested have been too small for stable results, several factors have been well established. (1) The cost to the customer of electric space heating, even with a small and well insulated home, will be in excess of $250 per season, which does not at present compare competively with other forms of house heating. (2) From a company standpoint the cost to serve this type of load (a high demand in the winter and a load factor considerably lower than that of the present residence customer) may well deserve much consideration.

[*Except for the first paragraph in which it is suggested that electric heating is more efficient in colder weather, the foregoing text is from the Detroit Edison report. What now follows is Electrical World's discussion of and inference from the data of the report* —**Editor**]

While the data of the study must be considered only in respect to the 29 installations included, it is permissible to derive an inference from their mutual relationships. This is to say that the way the installations covered in the study respond to changes in surrounding conditions that affect all of them is probably the same way that any group of installations would respond to the same changes.

The charts show parallel average data of maximum demand and degree-days for the weekday with the minimum temperature, for the weekday with the lowest mean temperature

(highest number of degree-days) and for the day of the system peak.

Upon examination of the relationship between demand and degree-days for these three days we find an interesting trend. For the day with the highest number of degree-days (Chart No. 2), the demand is 0.0945 kw per degree-day (4.63/49). For the next highest degree-day (Chart No. 3), the demand per degree-day (4.77/47) is 0.1015 kw. A considerably warmer day (Chart No. 4) shows 0.131 kw per degree-day (2.75/27). These figures show a decreasing demand per degree-day as the weather gets colder.

These figures of apparent greater efficiency in utilization of electricity for house heating in colder weather link-up with an indication observed in tests made by Portland General Electric Co and reported in Electrical World, May 18, 1953, page 163. This is that colder weather affects demand of the heating load less than would be expected.

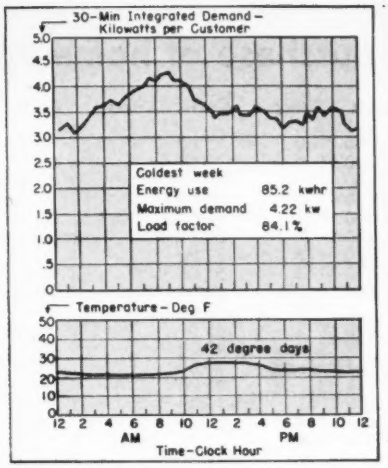


CHART NO. 1 ▲

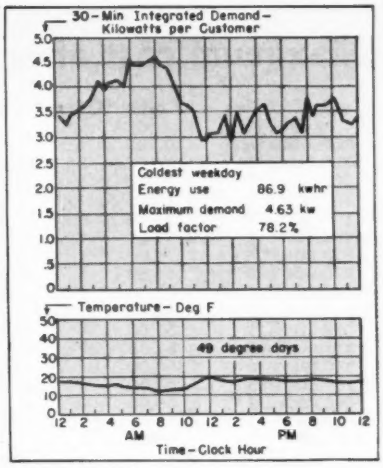
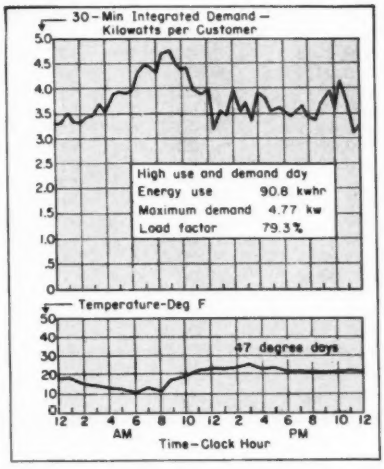
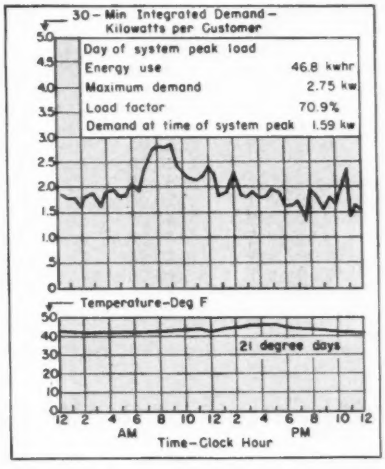


CHART NO. 2 ▲

▼ CHART NO. 3



▼ CHART NO. 4



MORE EFFICIENT UTILIZATION of electricity for house heating in colder weather is indicated by these graphs of averages for 29 installations in the Detroit area.

Caused by Under Capacity?

There arises some question as to the effect of possible under-capacity of heating installations on this apparent decreasing demand per degree-day with colder weather. Is there actually greater efficiency or is the limit of the connected load approached faster and consequently there cannot be a proportionate increase in demand as the temperature drops?

The following table shows the relationship between the theoretical hourly Btu output (connected load x 3,412.2 Btu/kw) of the twenty-nine Detroit house heating installations and the calculated hourly heat loss based on a design temperature of −10 deg F:

Ratio of Output/Loss	Installations
Less than 60%	8
60%–79%	13
80%–99%	5
100% and over	3
Total	**29**

Only three of these installations appear to have sufficient capacity to maintain an indoor temperature of 70 deg F with outdoor temperatures of −10 deg F. Five more are above 80% of the theoretical capacity.

As temperatures drop, but at some point before the design temperature is reached, it would seem that the entire connected load will be required to maintain a satisfactory indoor temperature.

The temperature in Detroit has not reached −10 deg F since electric house heating has been in use. It would appear that considerable dissatisfaction might arise if the temperature does actually fall that low and remain near 0 deg for a good part of the day. Are actual conditions as bad as this makes them appear to be?

An answer to this question may perhaps be found in the method of calculating design heat loss. The loss that is used in the foregoing discussion was figured in the classic manner used to determine combustion fuel requirements and which is commonly designated as the ASHVE method. In another article in this issue (page 91) it is shown that another method of calculating heat loss for electrical installations results in lower loss which is closer to actuality.

Also it is noted in the articles on tests in Cleveland and St. Louis (pages 84 and 94) that over-capacity, rather than under-capacity, is a common condition in house heating.

One can think of reasons other than the possibility of insufficient heating capacity for this apparent inverse relationship between degree-days and demand per degree-day. Generally speaking, there is less wind on colder days and wind is a real, although indeterminate, factor in heat loss. Another thought is that in colder weather the heating installation is in more nearly continuous operation and is thus more efficient, the frequency of high starting demand, characteristic of resistance heating, being minimized.

Maximum cost after purchase of home appliances . . .

Costs	Cities
220-v Service	
$300.00	1
200.00	3
180.00	1
175.00	1
160.00	2
150.00	4
140.00	3
130.00	1
125.00	4
120.00	1
115.00	3
110.00	6
100.00	15
90.00	8
85.00	2
80.00	3
75.00	7
65.00	2
60.00	2
56.70	1
55.00	1
51.75	1
50.00	1
42.50	1
40.00	3
35.00	3
30.00	8
10.00	3
0	37
Range	
$175.00	1
165.00	2
125.00	3
120.00	1
112.50	1
106.25	1
100.00	4
90.00	3
85.00	1
80.00	1
75.00	6
73.25	1
70.00	1
65.80	1
65.00	6
60.00	17
55.00	4
52.50	1
50.00	21
45.00	8
40.00	9
35.00	12
30.00	7
25.00	6
22.50	3
20.00	3
19.00	3
15.00	1
Clothes Dryer	
$125.00	1
100.00	4
90.00	2
80.00	1
75.00	1
65.00	3
60.00	4
55.00	1
50.00	13
45.00	5
42.50	3
40.26	1
40.00	11
37.50	1
35.00	9
33.00	1
30.00	26
29.00	1
28.00	3
26.10	1
25.00	18
23.00	3
20.00	10
15.00	2
10.00	3
Water Heater	
$200.00	1
190.00	3
185.00	2
175.00	1
165.00	2
164.50	1
160.00	1
145.00	1
140.00	1
130.00	1
121.40	1
120.00	5
112.50	1
110.00	4
105.00	1
104.00	1
102.50	1
95.00	2
93.60	1
93.20	1
90.00	2
86.00	1
85.00	3
80.00	8
75.00	9
72.00	3
70.00	16
65.00	2
62.50	3
60.00	8
57.00	1
55.00	9
50.00	12
49.00	2
45.00	7
40.00	3
36.00	1
35.00	3
30.00	1
27.50	2
Automatic Clothes Washer	
$125.00	1
100.00	3
95.00	2
90.00	4
85.00	4
82.50	1
80.00	2
75.00	6
73.00	1
70.00	6
65.00	10
64.93	1
62.00	5
60.00	2
55.00	3
52.00	1
50.00	6
47.00	5
45.00	12
40.00	6
37.50	1
37.00	3
35.00	8
34.00	1
32.00	1
30.00	4
29.00	1
28.00	1
27.50	1
25.00	7
22.50	1
21.50	1
20.00	4
18.00	1
15.00	3
12.00	3
10.00	6
Dishwasher	
$280.00	1
195.00	2
190.00	3
175.00	3
170.00	1
165.00	2
150.00	4
145.00	1
140.00	1
135.00	1
130.00	4
125.00	4
120.00	4
116.65	1
115.00	8
110.00	4
105.00	1
102.00	1
100.00	4
95.00	23
92.00	3
90.00	8
85.00	1
83.00	1
82.50	1
82.00	1
80.00	9
75.00	5
73.00	1
69.50	3
65.00	9
64.00	1
60.00	1
60.00	1
57.00	1
50.00	3
48.00	1
45.00	1
42.00	1
37.80	1
36.00	1
35.00	1
30.00	1
Food Waste Disposer	
$190.00	3
185.00	2
175.00	3
170.00	1
140.00	1
135.00	1
125.00	4
110.00	2
100.00	2
95.00	8
92.00	3
90.00	3
89.00	1
87.50	1
85.00	2
82.15	1
82.00	1
80.00	1
75.00	10
70.00	7
65.00	7
64.00	1
60.00	11
55.00	8
52.00	2
50.00	10
46.80	1
46.00	1
45.00	8
44.50	1
44.00	3
43.00	1
42.50	1
40.00	3
37.00	1
35.00	3
32.00	1
30.00	6
25.00	1
20.00	1

Minimum cost after purchase of home appliances . . .

Costs	Cities
220-v Service	
$125.00	1
100.00	2
85.00	2
75.00	7
70.00	3
65.00	2
60.00	9
55.00	2
50.00	7
45.00	3
40.00	14
38.00	1
35.00	14
34.55	1
32.50	3
30.00	5
25.00	4
20.00	4
15.00	4
5.00	3
0	37
Range	
$75.00	6
65.80	1
60.00	5
55.00	1
50.00	11
45.00	5
40.00	9
38.00	3
35.00	12
32.50	1
30.00	5
28.25	1
25.00	8
24.00	1
22.50	1
22.00	2
20.00	27
19.00	3
18.00	1
17.50	1
15.00	13
13.50	1
10.00	7
5.00	1
4.25	1
4.00	1
Clothes Dryer	
$60.00	1
50.00	7
45.00	3
40.00	7
35.00	1
32.50	3
30.00	2
25.00	16
22.00	1
21.78	1
20.00	30
18.00	4
16.00	1
15.00	23
13.00	1
12.50	1
12.00	1
11.70	1
11.00	2
10.00	18
8.00	1
5.00	2
4.25	1
Water Heater	
$121.40	1
110.00	1
107.00	1
105.00	1
89.50	1
85.00	4
72.50	1
72.00	3
70.00	3
69.50	1
67.00	1
65.00	3
60.00	4
56.00	1
55.00	7
50.00	12
49.00	2
48.00	3
45.00	13
40.00	16
39.47	1
38.00	1
37.00	1
35.00	8
34.00	1
32.00	1
31.00	3
30.60	1
30.50	1
30.00	3
29.00	1
28.00	1
25.00	11
24.00	1
22.50	1
21.00	1
20.00	6
19.00	1
18.50	1
17.00	1
15.00	1
13.00	1
10.00	1
Automatic Clothes Washer	
$75.00	1
52.50	1
45.00	14
40.00	9
35.00	4
32.50	2
32.00	2
31.46	1
31.00	1
30.00	6
28.00	1
27.50	4
27.00	3
25.00	9
23.50	1
23.00	1
22.50	1
22.00	3
20.00	1
17.00	1
15.00	16
14.50	1
14.00	1
13.50	1
13.00	3
12.75	1
12.50	1
12.00	2
11.00	1
10.00	21
9.00	3
8.00	2
7.50	1
5.00	1
0	7
Dishwasher	
$220.00	1
105.00	1
95.00	1
90.00	8
85.00	5
80.00	3
79.38	1
72.50	1
70.00	1
68.00	3
65.00	18
60.00	12
56.50	1
55.00	4
52.00	2
50.00	3
49.50	3
49.00	1
48.00	1
47.00	1
45.00	10
40.00	14
36.00	1
35.00	5
31.00	2
30.00	8
28.00	2
27.50	3
26.00	1
25.00	3
23.50	1
22.50	1
22.00	1
21.00	1
20.00	2
14.50	1
5.00	1
Food Waste Disposer	
$90.00	7
80.00	3
72.50	1
62.50	2
60.00	3
55.00	3
50.00	2
45.40	1
45.00	13
43.50	1
42.50	1
40.00	7
35.00	17
33.00	1
32.50	1
30.50	2
30.00	16
28.00	1
27.50	1
27.00	1
25.00	12
24.30	1
24.00	1
23.50	3
23.00	3
22.50	2
22.00	2
21.00	3
20.00	7
18.00	3
17.50	1
17.00	1
15.00	2
12.00	1
10.00	1
8.00	1

Average cost after purchase of home appliances . . .

Costs	Cities
220-v Service	
$150.00	2
125.00	3
115.00	2
100.00	6
85.00	3
80.00	4
75.00	9
72.50	1
70.00	2
65.00	8
60.00	10
57.50	1
55.00	2
50.00	12
48.87	1
43.20	1
40.00	3
37.50	1
36.66	1
35.00	6
30.00	5
25.00	1
22.00	1
17.50	3
7.00	3
0	37
Range	
$110.00	1
100.00	2
85.00	1
80.00	3
75.00	5
70.00	1
65.80	1
65.00	6
60.00	4
55.00	2
52.00	1
50.00	10
46.00	3
45.00	13
42.50	1
42.00	1
40.50	1
40.00	7
38.50	1
37.50	3
35.42	1
35.00	12
34.20	1
30.00	8
27.50	1
25.00	11
24.90	1
24.00	1
23.00	3
20.00	12
19.00	3
17.50	3
15.00	2
13.00	1
5.00	1
Clothes Dryer	
$75.00	4
57.50	1
55.00	3
50.00	4
45.00	4
42.50	1
40.00	8
37.50	3
35.00	2
33.00	1
32.50	2
30.00	13
27.63	1
27.50	2
27.00	3
25.00	18
24.48	1
22.00	2
21.00	3
20.00	20
19.00	3
17.50	2
16.00	1
15.75	1
15.00	18
14.00	2
12.00	1
10.00	4
Water Heater	
$121.40	1
117.00	1
116.00	1
110.00	2
107.50	1
105.00	2
100.00	1
95.00	1
90.00	1
89.50	1
89.20	1
81.00	1
80.00	1
76.00	3
75.00	2
72.00	3
70.00	12
67.50	2
67.00	1
65.00	4
62.00	1
61.00	1
60.00	11
58.00	1
57.50	2
55.00	11
52.50	3
50.50	4
50.00	8
49.00	2
47.50	2
45.50	1
45.00	2
44.50	1
43.00	1
42.50	2
40.00	5
39.00	3
38.00	4
37.00	1
35.00	6
33.00	1
32.50	1
30.00	6
29.00	1
27.50	1
25.00	1
21.00	11
20.50	1
19.00	1
Automatic Clothes Washer	
$75.00	1
70.00	4
63.00	3
61.00	1
60.00	4
58.00	2
55.00	4
53.00	3
52.50	1
50.00	4
48.00	1
47.50	1
46.00	1
45.00	2
44.00	1
43.50	1
43.00	2
42.50	2
42.00	1
40.00	6
38.75	1
35.00	5
32.50	1
32.00	3
31.00	1
30.00	12
27.00	4
25.00	10
23.00	1
22.50	6
22.00	1
21.00	1
20.50	2
20.00	11
18.00	1
17.50	1
17.00	1
15.45	1
15.00	5
14.00	2
13.00	3
12.00	1
10.50	3
10.00	6
Dishwasher	
$225.00	1
137.50	1
136.00	1
125.00	1
122.50	1
122.00	1
120.00	3
110.00	7
105.50	1
102.50	2
100.00	1
98.29	1
97.50	1
95.00	3
90.00	3
87.50	1
85.00	4
84.00	1
82.50	1
82.00	1
80.00	7
77.50	1
77.00	3
76.00	3
75.00	7
73.00	2
72.50	1
72.00	1
70.00	1
67.50	1
65.00	9
62.50	1
62.00	3
60.00	7
59.98	1
58.00	1
57.50	3
57.00	1
56.50	1
55.00	7
53.00	4
52.50	1
52.00	2
50.00	2
49.16	1
49.00	1
48.00	1
47.00	1
46.50	1
45.00	2
42.50	1
42.00	1
41.00	1
40.00	2
35.00	2
30.50	1
30.00	2
28.00	1
27.45	1
27.00	1
24.50	1
20.00	1
Food Waste Disposer	
$136.00	1
120.00	3
110.00	3
105.00	4
97.00	1
87.50	1
75.50	1
75.00	1
73.75	1
72.50	1
72.00	1
70.00	1
66.08	1
65.00	2
62.00	3
60.00	4
55.00	5
54.75	1
53.00	1
52.00	3
50.00	9
49.00	1
45.80	1
45.00	19
42.50	5
41.50	1
40.00	10
38.50	1
38.00	3
37.50	4
36.50	1
36.00	2
35.00	1
33.00	1
32.00	4
30.00	10
29.70	1
29.00	1
27.50	1
26.00	1
25.00	5
24.50	1
23.00	2
22.00	1
20.00	1
18.00	1
15.00	1

. . . To Be Added to the Price

How much more than the price of a major appliance does the purchaser have to pay in order to get it into use in his home?

In a survey made by the marketing research department of General Electric's major appliance division, 49 utilities reported the added costs for 128 cities, as shown in the accompanying tables. For those appliances that require plumbing, this is included. These costs are those paid by the customer except in cities where they are partially or wholly covered by allowances made by the utilities. Only three appliances are so covered, the range in 17 cities, the water heater in 14, and the clothes dryer in 7, as shown at right.

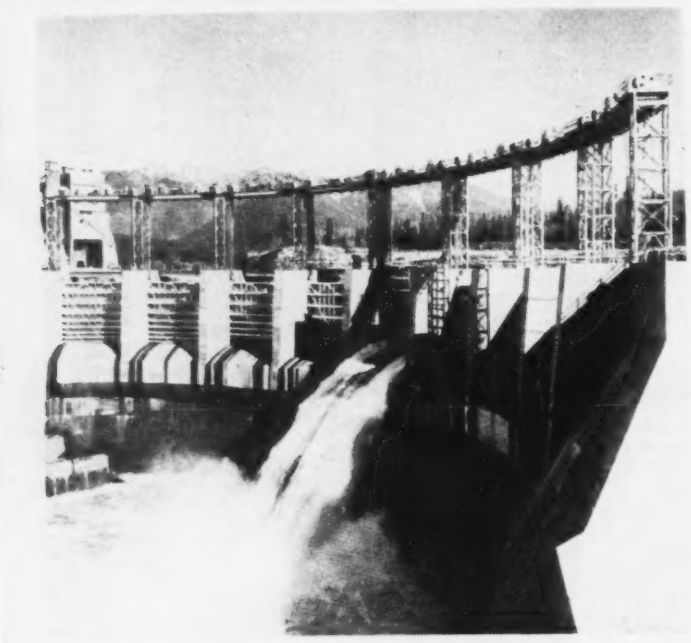
Three tables above show average, maximum, and minimum costs for bringing 220-v service into the home and for six major appliances. They are arranged in descending order and are related to the numbers of cities in which they represent the prevailing pricing practice.

Distribution of Utility "Wiring" Allowances Among Cities

CLOTHES DRYER	
$45.00	3
25.00	1
20.00	3
0	121

WATER HEATER	
$101.40	1
Up to $45.00	6
Up to $37.00	3
Up to $20.00	3
Up to $10.00	1
0	114

ELECTRIC RANGE	
$45.80	1
45.00	3
42.50	1
40.00	3
35.00	1
25.00	2
20.00	3
7.50	3
0	111



Here's one that hasn't cost you a cent in taxes!

When tax-paying, business-managed electric companies can build, finance and operate giant power projects, isn't it extravagant for the federal government to spend your tax money to build them?

This important question for U. S. taxpayers is raised by America's Electric Light and Power Companies.

A Lesson for the Taxpayer

The Cabinet Gorge project of Washington Water Power Co is used as an example of the value of allowing private companies to develop the nation's hydro resources in this advertisement of the Electric Companies Advertising Program. This advertisement will appear in fall issues of nationally circulated magazines such as Collier's, the Saturday Evening Post, the American Magazine, and various farm publications.

'Hardest Working River' Film Free to Industry

Wisconsin Power & Light Co is making available to the industry its 16-mm sound color film showing how private enterprise has developed the Wisconsin River. "The Nation's Hardest Working River" portrays the industrial and recreational development of the Wisconsin on which are located 26 power and flood control dams. (EW, Aug. 14, 1948).

The 29-minute film, which was produced by the power company with the assistance of the University of Wisconsin's photographic laboratory, is available without cost for showing to groups. It may also be telecast. Inquiries should be addressed to: The Public Information Department, Wisconsin Power & Light Co, Madison, Wis.

Co-op Executives Study

About 45 executives of Georgia co-ops attended the course on personnel training and communication given recently at the University of Georgia. Course was co-sponsored by the Georgia Electric Membership Corporation.

5 Judges Named to Pick Champion Home Towns

Three persons from Georgia and two from neighboring states have agreed to serve as judges for the 1953 Champion Home Town Contest sponsored by Georgia Power Co.

The Georgians are Mrs. Agnes Reasor Olmstead, identified as "Nancy Carter," home economics director of Colonial Stores, and former woman's editor of the Atlanta Constitution; Howard K. Menhinick, regents professor of city planning, School of Architecture, Georgia Institute of Technology; and Clarence H. Walker, executive staff representative, Coca-Cola Co.

Other judges are Miss Iris Davenport, woman's editor of Farm and Ranch Magazine, Nashville, Tenn.; and Joe Jennings, superintendent of the Cherokee Indian Agency, Cherokee, N. C.

Arizona Utility Enlists Kiddies in Safety Drive

As a part of its program to promote safety among its employees, Arizona Public Service Co has enlisted their children. The company recently conducted a contest among them. They were asked to complete in 25 words or less this sentence, "I want my Dad to be a safe worker because . . ." The rules permitted parents to assist children in writing entries.

Winning boy and girl each received a bicycle. The boy placing second was given a ball glove, the girl a doll.

SCANNING THE ADS

Connecticut Light and Power Co—The clock is portrayed as the "servant that became a master." Theme of the ad is that electricity helps the housewife beat the clock by doing so many jobs for her. Left side of the ad is taken up by a drawing of a banjo clock.

Georgia Power Co—Company is running a series of ads in its districts playing up local employees. Ads are of the testimonial type with a quoted head from the copy and a short biography of the employee.

WASHINGTON COMMENT

JESSE MOCK

TVA—A Unique Experiment Now a Unique Problem

The Tennessee Valley Authority enjoys a distinction of its own. Under the Democratic administrations, it was a unique experiment. Under the Eisenhower administration, it is a unique problem.

Right now the administration must decide TVA's future course. The real issue is whether the agency shall be allowed to go on expanding to meet growing area power needs or whether it should be held pretty much to present size.

This question comes before Congress next year in two separate measures:

1. The Dondero Bill which would knock the "sole supplier" clause out of contracts between TVA and its utility customers.

2. The regular Appropriation Bill which charts the size of generation capacity to be built by TVA.

If Congress declines to appropriate money for additional generating plants, as it did last session, TVA power expansion will be nipped upon completion of plants already under construction. Purpose of the Dondero Bill would be to permit TVA power customers to provide for power needs from sources other than TVA.

Eisenhower Has His Doubts . . . President Eisenhower, himself, is plainly having trouble finding both a philosophical and politically practical position to take on TVA expansion. At three of his press conferences he has been asked for his views toward TVA. His answers seem to boil down to this: He cannot reconcile the general theory of TVA with his own political views, nor is he able from a practical standpoint to determine just how the agency should be dealt with.

Interior Secretary Douglas McKay has freely expressed his personal views on the subject. "If the people of the area want it, it's all right with me."

More extreme views have been expressed by two other Republicans who have a hand in recommending government policy.

Herbert Hoover, head of the new commission of government reorganization and functions, has said the government should get out of the power business.

More recently Dr Clarence E. Manion, chairman of Eisenhower's commission on inter-governmental relationships said, "I think TVA should be sold to private business." He added, "I don't think the federal government should have built the TVA project in the first place."

While the president and his advisers appear to have a considerable area of disagreement on how to handle TVA, backers of the agency are putting together a coordinated program of support. State and municipal political leaders in the area speak with a single voice in pleading for continued TVA expansion.

More important, the area leaders appear to be getting a large measure of support from federal power advocates over the country. TVA Chairman Gordon Clapp, a Democratic appointee whose term expires next May, is a backer of TVA expansion and puts his views on record at frequent intervals.

TVA Backers Willing to Fight . . . These backers seem not only ready, but anxious, to meet the issue of TVA expansion head on. A recently formed organization—citizens for TVA, Inc—is out to raise $100,000 to pump for continued expansion. Presumably the new citizens organization will join with the Tennessee Valley Public Power Association to get pro-TVA views across to Congress.

No doubt the federal power advocates outside the valley would be pleased to pitch their battle on the TVA issue. After all, TVA is fairly widely and favorably known. Its backers are well organized and have a fair block of Congressional support. A victory at this point would rally other segments of the federal power movement.

There is cause to wonder whether the federal power supporters have now chosen the weapons and picked the site for a showdown with the Eisenhower administration. If so, the TVA problem may no longer be unique nor regional. Its implications could be, instead, general and national.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Insulation-resistance tests of conductors in 62 non-leaded dc control cables disclosed failure of insulation of 59 of the 160 conductors in 20 of the cables, due primarily to moisture entrance.

Live-line maintenance is contemplated for the extra-high-voltage systems now being constructed.

Load growth on one system had been so consistent that it failed to continue only during 2 months in all of 36 years.

Peat in dried, pulverized state will flow through hoppers if kept in "fluidized" condition by suspension in a moving air stream.

Midpoint grounding of the 440-v auxiliary system permits the ues of 277-v ballast fluorescent lighting for the turbine room ceiling.

Dry runs are a good check measure to make sure that the newly assembled operating staff really understands the intricacies of a new plant.

Wheel guards on the coal tripper are a logical antidote if operators let the tripper run over their fingers with distressing frequency.

Simple radial auxiliary systems for unit-type power plants are substantiated by the demonstrated reliability of appropriate transformers and switchgear.

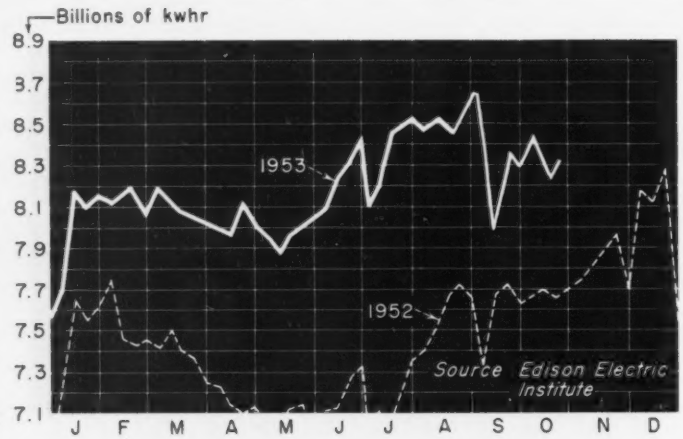
Heat pump saturation of only 10% would increase total residential power consumption by 65%.

Starting fans of OA/FA and OA/FO/FA transformers at 70C winding hot spot is too early for most effective overall use of the transformer and its cooling equipment. Starting them at 90C is corresponding too late according to recent researches.

Motor trouble on three-phase air-conditioning units may be caused by moderate voltage unbalance on heavy-loaded motors.

Higher harmonic dominance in cold-rolled steel renders the noise generated in transformers by it more objectionable than that produced by hot-rolled steel.

STATISTICS



Output Week Ended Oct. 24—8,306,426,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Oct. 24	+7.9	+6.1	+2.9	+2.5	+4.2	+17.8	+11.3	+6.8	+24.6	+4.0
Oct. 17	+7.6	+5.6	+3.0	+2.1	+3.6	+17.7	+9.0	+7.0	+23.2	+5.1
Oct. 10	+7.9	+7.2	+4.0	+3.3	+5.3	+15.6	+8.5	+7.0	+22.0	+6.5

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	July	76.6	76.0	67.2
Capacity (Million Kw)	July	86.13	85.06	77.96
Production (Billion Kwhr)	Aug.	38.50	38.03	34.36
Hydro	Aug.	8.45	8.75	8.52
Fuel	Aug.	30.04	29.28	25.84
Fuel Consumption				
Coal (Million Tons)	Aug.	9.70	9.59	8.58
Oil (Million Barrels)	Aug.	6.55	6.35	5.37
Gas (Billion Cu Ft)	Aug.	112.88	109.35	105.40
Sales (Billion Kwhr)	July	32.13	31.77	27.70
Residential	July	8.47	8.37	7.50
Commercial	July	5.81	5.46	5.30
Industrial	July	15.50	15.80	12.64
Other	July	2.35	2.14	2.25
Net Income Class A & B Companies ($ Million)	Aug.	77.35*	74.11	69.39
Estimated Dec. '53 Peak (Million Kw)	Aug.	86.2	86.2	88.4
Kwhr per Residential Customer (12 Month Average)	July	2,273	2,257	2,104
Revenue per Kwhr Residential Service (12 Month Average)	July	2.76¢	2.76¢	2.78¢
Canadian Production (Billion Kwhr)	July	5.18	5.26	4.84

Business Statistics

FRB Industrial Production Index†††	Sept.	128.9	129.2	125.8
Gross National Product Annual Rate ($ Billion)	2ndQtr.	372.4	362.0	345.1
EW 5 Industry Production Index	Sept.	128.9	129.2**	125.8
ENR Construction Cost Index††	Aug.	128.3	126.6	122.7
BLS Consumer's Price Index	Aug.	115.0	114.7	114.3
NEMA Insulation Materials Sales Index†	Aug.	153	150	128
NEMA Electric Appliance Sales Index†	Aug.	90	84	100
NEMA Household Refrig. Sales Index†	Aug.	63	87	75
Metal Prices (Oct. 27)				
Copper, Conn. V., lb		$.29-.30	.29½	.24¼
Lead, N. Y. lb		.13½	.13½	.13¼
Zinc, prime Western E. St. Louis, lb		.10	.10	.12¼
Tin, Straits, qual. N. Y., lb		.80	.82½	1.21½
Aluminum, ingot, base price		.21½	.21½	.20
Nickel, base price		.60	.60	.56½
Steel billets, Pitts., ton		62.00	62.00	59.00
Steel, scrap, No. 1 heavy, Pitts., ton		36.00	38.00	46.00

*Preliminary **Revised †1947-49=100 ††1949=100 †††Unadjusted

Steam Accounts for 83% of Power Co Capacity

The 2,000-odd generating stations of the larger private utilities throughout the country had a combined installed capacity of over 64 million kilowatts at the end of 1952, according to the Federal Power Commission's recently released annual report on class A and B companies. Steam is by far the leading type of prime mover, representing 83% of the total capacity, hydro accounts for another 16%, while internal combustion makes up the remaining 1%.

Generating Stations—1952

	Installed Capacity	Total Plants
Steam		
0 to 1,000	17,703	25
1,001 to 2,000	24,300	14
2,001 to 5,000	199,915	54
5,001 to 10,000	825,731	110
10,001 to 25,000	2,017,465	115
25,001 to 40,000	2,317,993	69
40,001 to 60,000	2,724,394	53
60,001 to 100,000	5,890,198	73
Over 100,000	39,470,480	170
Total steam	**53,488,179**	**683**
Hydraulic		
0 to 1,000	157,613	349
1,001 to 2,000	230,835	153
2,001 to 5,000	534,173	158
5,001 to 10,000	787,330	106
10,001 to 25,000	1,487,740	89
25,001 to 40,000	1,212,580	38
40,001 to 60,000	1,459,800	29
60,001 to 100,000	1,985,670	26
Over 100,000	2,395,000	16
Total hydraulic	**10,250,741**	**964**
Internal Combustion		
0 to 500	39,328	142
501 to 1,000	48,060	62
1,001 to 2,000	143,819	93
2,001 to 5,000	233,045	74
Over 5,000	150,342	19
Total IC	**614,594**	**390**
Total Production	**64,353.514**	**2,037**

Electrical Energy Account—1952

	Thousands of kwhrs
Generation (excluding station use)	
Steam	267,889,665
Hydraulic	53,697,449
IC engine	659,712
Total generation	322,246,826
Purchases	50,852,672
Interchange (gross)	18,370,482
Total	**391,469,980**

Consistent with the proportions of capacity that each type of prime mover represents are the proportions of energy produced. Steam generated a little over 83%, hydro 16½%, and internal combustion about .2% of energy produced in 1952.

Connecticut L&P Rates Hiked

Connecticut Public Utilities Commission grants only 55% of the proposed $3,133,385 a year increase asked for by company

In what may well be one of the most controversial findings in recent rate proceedings, the Connecticut Public Utilities Commission disallowed 45% of the proposed $3,133,385 electric rate increase filed by the Connecticut Light & Power Co. The commission, however, allowed the filed gas and water increases to stand unchanged.

The commission stated in its decision that:

"The overall effect of the revisions proposed by the company would amount to an increase of 6.9%. For electric service, the average increase would be 10.8% for residential service; 9.3% for commercial service; 4.5% for industrial service and a reduction of 2.8% for street lighting."

Efficiency of New Generating Plants . . . The PUC emphasized the efficiency of new generating units going on the lines and the recovery of costs through fuel adjustments by saying:

"Since 1949, unit operating costs have trended generally upward. New and more efficient plant, particularly in the electric department, however, has enabled the company to offset much of the effect of these higher unit operating costs. Moreover, as a greater percentage of the company's total generating capacity is comprised of new and more efficient units, there will be an increase in this trend. In addition, increases in the cost of fuel, the largest single cost of operation of the company, are largely recovered through the fuel adjustment clause."

As regards to the rate of return, the PUC confined itself to the cost of money principle by saying, among other things:

"If we were to give a higher return to the company than the market demanded simply because some other companies required it, the market would promptly reflect this bonus, the price would rise, and the yield would remain the same or even decrease, thereby not affecting the cost of money at all, or if it affected it at all, by emphasizing the discrepancy between actual and theoretical cost of common shares.

"If dividends were increased, it would unnecessarily compensate the shareholders for a risk which they had already discounted by accepting and holding the shares at a lower yield . . . Regardless whether any company representative or witness feels subjectively that the earnings of the company are too low to attract capital, the judgment of the investor governs. It matters not what investors **ought** to think about the company or what value they **could** or **might** place on the company's earnings.

"The controlling fact is what value they **do** place on it . . . For the above reasons, it appears that reference to the arithmetical average of the earnings-proceeds ratios for 56 stock issues of 19 companies is not controlling as a measure of the reasonable cost of this particular company's common stock component of its capitalization . . . Utilizing the capitalization ratios found reasonable above of 44% debt, 18.3% preferred and 37.7% equity, this results in a cost of capital to this company of 5.54% as a component in fixing the rate of return."

Rate Base Findings . . . As regards the findings in the rate base, the only difference between the company's and the commission's rate base is that the commission deducted approximately 45% of the income tax accruals from working capital in arriving at the allowable rate base.

As to the need for rate relief, the commission stated:

"There is little doubt that such a level of earnings is adequate, bearing in mind the considerations employed in reaching our conclusion on a fair cost of capital. It is especially striking that this rate, which is more than 3/10ths of a per cent below the minimum return which company's financial analyst deems necessary, would, nevertheless, place the company's bond coverage on as high a level as the highest grade Triple A companies, even with its debt ratio close to the national average. We, therefore, find that rates which will yield a return of 5.6% on the rate base found reasonable above for 1953 are adequate and no more or less than just and reasonable."

Reasonableness of Operating Expenses . . . As to the reasonableness of operating expenses, the commission, while previously rejecting the use of comparable data of other companies in its findings on the cost of money, had this to say with regard to expenses:

"We find, therefore, that the comparison between experience of this company and the experience of the 19 companies is a fair method of testing the objective reasonableness of the company's direct operating expenses."

Among other findings on the question of reasonable expenses, the commission disallowed $98,500 of advertising expenses allocated to "institutional" advertisements. It said:

"We hold only that if the company wishes to incur such expenses, it do so at the expense of its owners to whose advantages such efforts, if successful, will immediately inure, not at the expense of the ratepayer."

The findings went on to say:

". . . the company is earning under its present experience at a rate of return of 4.99%. Since we have found above that the fair return for the company is at least 5.54%, we find that the present schedule of rates and charges is yielding less than a fair return, that it is accordingly less than just and reasonable and that it should be adjusted upwards."

Yield of 5.95% on Rate Base . . . The commission made the point that the proposed rates of the company would yield 5.95% on the rate base. It then said:

"We have found the return which the company needs on each dollar of plant supplied by the investors is at least 5.54%, if it is to maintain its ability to attract and hold capital. We find, therefore, that the schedule of rates and charges under investiga-

tion and suspension in this proceeding will yield operating income which is more than necessary for the company."

In its conclusions, the commission said:

"The company states in at least three places in the record, including its brief, the testimony of the company's president and of its financial analyst that a return higher than 5.52% is not asked for in this proceeding because it feels it can obtain additional revenues through more efficient operation . . . Our examination discloses that since the company can preserve its financial integrity with a return no greater than 5.63% on the rate base found reasonable by the commission, or a 5.52% return on the rate base claimed by the company, there is no justification for authorizing rates materially higher."

PUD's Will Fight WWP-Puget Consolidation Plans

Condemnation suits against Puget Sound Power & Light Co properties will be activated and the Washington State Public Service Commission approval of the merger of that company with Washington Water Power Co will be appealed to the courts, the executive committee of five PUD's declared after a meeting at Seattle.

"The decision by the PSC approving the merger is so contrary to the weight of the evidence presented during the lengthy hearings that we have no other alternative than to appeal such decision and, if necessary, resort to the highest court for correction," said Harvey Benson of the Skagit PUD, chairman of five-PUD group.

Guy C. Myers, original PUD promotor, is reported to have resumed negotiations with eastern and midwest financial houses to reorganize a syndicate which would undertake to finance PUD purchase of Puget, in the event the merger is delayed beyond the present agreed expiration date of Nov. 19.

The Federal Power Commission has set Nov. 9 to hear the application by WWP for authority to acquire the facilities of Puget.

The Washington PSC has authorized the payment of the 37½¢ a share common stock dividend declared payable Nov. 16 to stock of record Oct. 28 by the directors on Oct. 16.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stock			Common Stock		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE 1953									
Oct. 22	**3.14**	**3.17**	**3.41**	**4.20**	**4.38**	**4.68**	**5.17**	**5.68**	**5.81**
Oct. 15	3.17	3.21	3.42	4.24	4.42	4.73	5.22	5.67	5.86
END OF QTR									
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50
4th 1952	2.99	3.03	3.14	4.06	4.22	4.59	4.98	5.33	5.62

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Alabama Power	12	Sept.	$12,573,584	$11,726,611	$....	$....
Arkansas Power & Light	12	Sept.	7,088,766	5,980,150	....	....
Detroit Edison	12	Sept.	20,946,693	16,119,239	1.97(a)	1.62(a)
Georgia Power	12	Sept.	12,368,553	11,644,247	....	....
Louisiana Power & Light	12	Sept.	3,528,856	2,983,211	....	....
Mississippi Power & Light	12	Sept.	4,142,308	3,708,475	....	....
Mountain States Power	12	Aug.	1,769,672	1,493,160	1.27	1.05
Niagara Mohawk Power	12	Sept.	25,472,606	23,059,897	2.00	1.96
Ohio Edison, consolidated	12	Sept.	18,485,866	15,251,344	3.02(b)	2.81(b)
Portland General Electric	12	Sept.	3,700,759	3,782,558	2.47(c)	2.75(c)
Southern Co, consolidated	12	Sept.	21,738,004	19,931,371	1.20(e)	1.16(e)
Southern Indiana Gas & Electric	12	Sept.	2,138,218	1,813,009	2.16(f)	2.04(f)

Notes—(a) Based on 10,629,793 shares in 1953 and 9,924,023 shares in 1952; (b) Based on 5,278,306 shares in 1953 and 4,798,460 shares in 1952; (c) Based on 1,500,000 shares in 1953 and 1,375,000 shares in 1952; (e) Based on 18,087,643 shares in 1953 and 17,076,669 shares in 1952; and (f) Based on 799,167 shares in 1953 and 685,000 shares in 1952.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF OCTOBER 22-28			
Bonds			
Public Service Electric & Gas—1st mtg 3¼% due 1983	$30,000	101.34%	3.18%
Gainesville, Fla.—water and electric revenues due 1956-1976	1,300	various	1.75-2.80
Niagara Mohawk Power—gen mtg 3¼% due 1983	40,000	100.625	3.22
Common Stock			
Hartford Electric Light—105,500 sh (being offered commonholders on a 1-for-8 basis, record Oct. 23 to expire Nov. 10)	$4,642	$44.00	6.25%
Central Illinois Light—100,000 sh (being offered commonholders on a 1-for-9 basis, record Oct. 27 to expire Nov. 13 with an oversubscription privilege)	3,650	36.50	6.03
SCHEDULE FOR NOVEMBER—DECEMBER—JANUARY			**Bid Date**
Bonds			
Long Island Lighting—1st mtd due 1983	$25,000	.....	Nov. 9
Gulf States Utilities—1st mtg due 1983	10,000	.....	Nov. 23
Monongahela Power—1st mtg due 1983	10,000	.....	Dec. 1
Ohio Edison—1st mtg due 1984	30,000	.....	Jan. 19
Preferred Stock			
Worcester County Electric—75,000 sh $100 par	$7,500	.....	Nov. 17
Duquesne Light—100,000 sh $50 par	5,000	.....	.....
Common Stock			
Delaware Power & Light—232,520 sh (to be offered common holders on a 1-for-7 basis, record Nov. 25 to expire Dec. 15; employees to be given right to subscribe up to 150 shares)	.....	.....	.....
Virginia Electric Power—558,946 sh	.....	.....	.....
Ohio Edison—527,830 sh (to be offered commonholders on 1-for-10 basis, record Jan. 11)	.....	.....	.....
POSTPONED, UNSCHEDULED, AND/OR UNDER CONSIDERATION			
Bonds			
Southwestern Public Service—1st mtg	$12,000(e)	.....	.....
Illinois Power Co—1st mtg	20,000	.....	.....
Florida Power Corp—1st mtg	10,000(e)	.....	.....
Houston Lightning & Power—1st mtg	25,000	.....	.....
Public Service Co of Colorado—1st mtg	15,000	.....	.....
Delaware Power & Light—1st mtg	10,00(e)	.....	.....
Brazos River Authority, Tex.—electric revenues	66,000	.....	.....
Preferred Stock			
Southwestern Public Service	$3,000(e)	.....	.....
Narragansett Electric—150,000 sh $50 par	7,500	.....	.....
Common Stock			
Iowa-Illinois Electric & Gas	$6,000(f)	.....	.....
Southwestern Public Service—(to be offered on about a 1-for-13 basis)	.....	.....	.....

Notes—(e) Estimated; and (f) To sell enough common stock to yield $6 million.

NEW PACKAGE with color code stamping (green for Type "K" and blue for Type "T") identifies new G-E EEI-NEMA fuse links. Inset shows complete conversion procedures, co-ordination charts, and time-current curves to simplify proper fuse selection.

G-E's new EEI-NEMA universal cable-type fuse links provide extra benefits from fuse link standardization

And it's Easy and Economical to Convert to G-E Standard Links

GENERAL ELECTRIC'S new EEI-NEMA standard fuse links not only meet all of the utility-sponsored EEI-NEMA requirements, but also offer many additional operating benefits. They provide both electrical and mechanical interchangeability . . . long desired by users . . . and there's a Type "K" (fast) and a Type "T" (slow) G-E standard link in both preferred and non-preferred ratings, for replacing practically any nonstandard links now in use.

G-E's standard links give EXTRA benefits. Low melting temperatures prevent drying, embrittling, or burning of auxiliary tubes or fuseholder tubes . . . thereby maintaining the full interrupting capabilities of the cutout.

Extra-long auxiliary tube gives greater dependability for low fault currents, and better full-range operation of any cutout.

High continuous-current-carrying capabilities enable continuous over-current rating in excess of standard ratings, and simplifies replacement of N-rated links with practically no change in equipment protection.

Higher accuracy of electrical characteristics gives you greater assurance of attaining planned protection and co-ordination, with more dependable isolation of faults and minimizing of system outages.

Mechanical construction combines liberal strength of fusible element and strain wire with extremely flexible cable that permits free indicating and dropout action of cutouts.

It's easy and economical to convert to G-E standard links—there's no need for a new co-ordination study—in general, you simply replace section and branch fuse links with the proper G-E Standard fuse links; thereafter you replace equipment fuses with G-E Standard fuse links at the most opportune time—when equipment fuses blow or as equipment is serviced. You won't have to throw away your present equipment fuse links.

There's a G-E Standard fuse link to give practically the same equipment protection as any "N" rated fuse link you are now using.

For information, get in touch with your nearest G-E representative, or write to General Electric Co., Section 433-1, Schenectady 5, New York.

You can put your confidence in—

GENERAL ELECTRIC

DISTRIBUTION TRANSFORMERS

different from others because.....

...One-piece cover band

facilitates inspection...maintains uniform gasket pressure around rim

This simple, efficient General Electric method of providing uniform gasket pressure between cover and tank maintains "factory sealing" even after years of service.

Seal is air-tight so that moisture-laden air can't be drawn into tank to contaminate oil and shorten transformer life.

ONE-PIECE COVER BAND increases accessibility for inspection or maintenance. One bronze alloy bolt holds cover tightly in place—only a screwdriver is needed to remove or tighten the band. No adhesives to break when removing cover—no surfaces to clean before resealing. *You even re-use the same nitrile gasket* . . . again and again.

REMEMBER . . . all transformers are not alike . . . compare the General Electric plus features in the chart below and see for yourself.

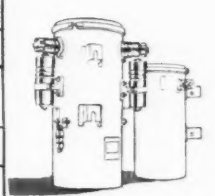
For more information on distribution transformers, either unit-type or conventional, contact your nearest G-E sales office, agent or distributor, or write to General Electric Company, Section 431-6, Schenectady 5, New York.

You can put your confidence in—

GENERAL ELECTRIC

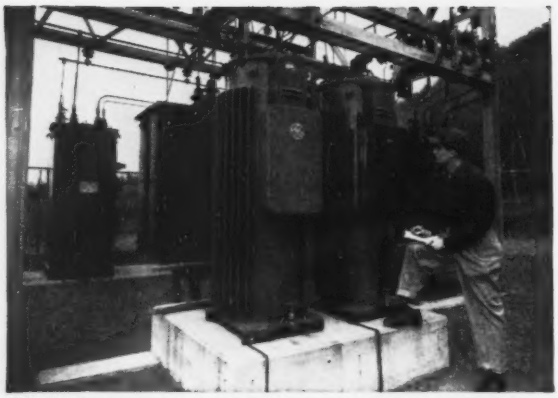
ALL TRANSFORMERS ARE NOT ALIKE
(make this simple comparison and see)

FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	YES	NO	NO	NO	NO	NO
Nitrile rubber gaskets at all tank openings	YES	NO	NO	NO	NO	NO
Strenicor pressure terminal clamps	YES	NO	NO	NO	NO	NO
Insulated clamp-type connectors on tank wall hv bushings	YES	YES	YES	NO	YES	YES
One-piece cover band	YES	NO	NO	NO	NO	YES
Terminals designed for both copper and aluminum conductors	YES	NO	NO	NO	NO	NO
Gapped valve-type arresters	YES	NO	NO	NO	NO	NO
Nationwide company-operated service facilities	YES	YES	NO	NO	NO	YES



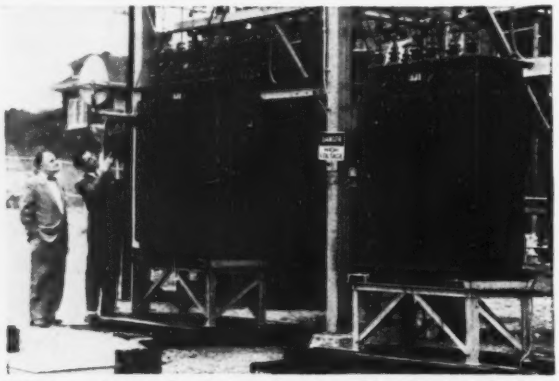
UNIT-TYPE CONVENTIONAL

"Take your choice G. E. makes both"

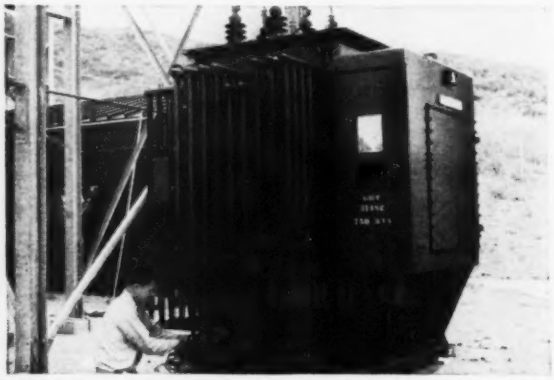


IRS single-phase induction regulators supply the finest regulation obtainable for heavily loaded feeders where voltage variations are frequent and immediate response essential. Their sealed tank construction prolongs oil life.

ML32 step regulators provide low-cost dependable regulation on branch and rural circuits in thirty-two 5/8% steps. As with all G-E station-type voltage regulators, controls of the ML32 maintain Class I accuracy.



IRT three-phase induction regulators combine three single-phase IRS regulators in one tank with a single set of controls. They provide high quality stepless regulation for balanced loads. Rugged construction assures long life.



MLT32 three-phase step regulators adjust voltage in thirty-two 5/8% steps. Best suited for lines with balanced loads, they feature rugged simplicity in construction—accessibility and ease of maintenance of switching mechanism.

Solve any feeder voltage problem with one of these G-E regulators

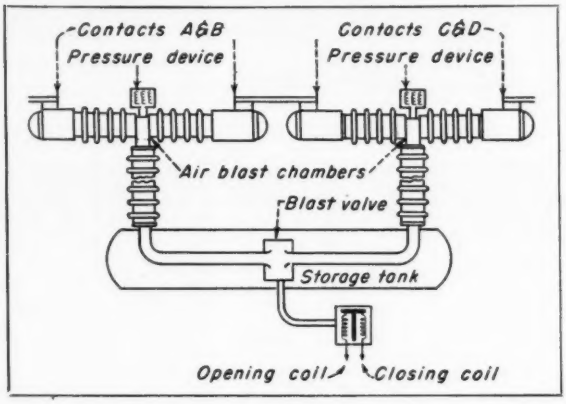
You can get exactly the type of voltage correction you need . . . dependable, low-cost regulation . . . the finest regulation obtainable . . . for circuit capacities from 125 kva at 2.4 kv to 25,000 kva at 69 kv . . . by choosing from General Electric's complete line of voltage regulators.

G-E Induction Regulators, with their prompt response to voltage variations, smooth stepless control, and negligible maintenance, provide the highest quality regulation obtainable. They're available for circuits 15 kv and below, 3000 kva and below . . . single-phase for individual phase control . . . three-phase for balanced loads.

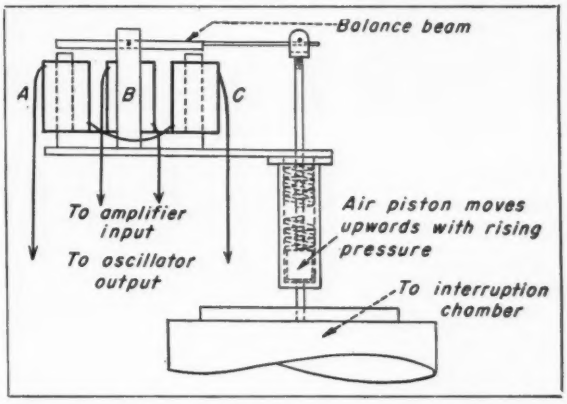
G-E Step Regulators offer economic advantages where you handle large blocks of power at higher voltages, and where you need supplementary regulation on your branch and rural feeders. G.E.'s MLT32 three-phase step regulator is available for all standard voltages up to 69 kv, circuit capacities up to 25,000 kva . . . ML32 single-phase regulators offer ±10% regulation in thirty-two 5/8% steps in ratings 13,800Y/7960 volts and below, for three-phase banks rated approximately 2000 kva and below.

For more information on IRS, IRT, MLT32, ML32 regulators, see your local G-E representative or send for bulletins GEA-2985, GEA-2985C-1, GEC-716, GEA-5752, respectively. General Electric Company, Schenectady 5, New York. 423-2

GENERAL ELECTRIC



BROWN-BOVERI BREAKER, Type DCVF, was difficult to test because of its high operating speds. To conquer this problem a . . .



PRESSURE RECORDER was devised to change air pressure in the blast chamber to an electric signal, recorded by an oscillograph

Oscillograph Tests High-Speed Air-Blast Breakers

FRANK KUNZE, Chief Inspector, Electrical System, Detroit Edison Co, Detroit, Mich.

Opening speeds of certain types of compressed air circuit breakers on Detroit Edison's system are so high that they cannot be measured accurately with a cycle counter. The company has developed a special instrument to facilitate testing of newly purchased Brown-Boveri Type DCVF 138-kv breakers. It produces an oscillographic record of breaker operation.

Brown-Boveri Type DCVF is a self-contained breaker with four series contacts in each phase. Contacts are opened by an air blast that is admitted to the interrupting chamber by an electrically and pneumatically actuated blast valve.

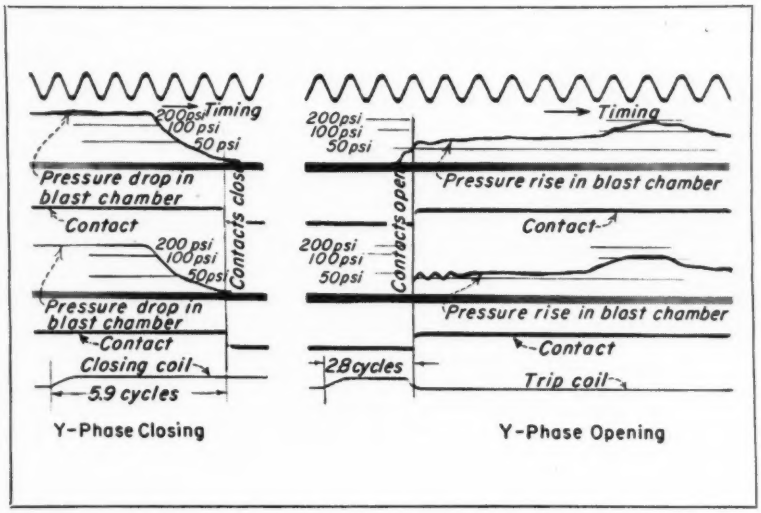
Air moves the contact axially to the open position. At the same time, high-velocity air sweeps the arc off the stationary contact. When the moving contact has reached its maximum travel, the air passage to atmosphere is sealed off. Contacts are then held open against compressed closing springs by air pressure from an air storage tank.

To close the breaker the blast valve is again operated. This time, it releases air from the interrupting chamber, allowing compressed closing springs to close the contacts.

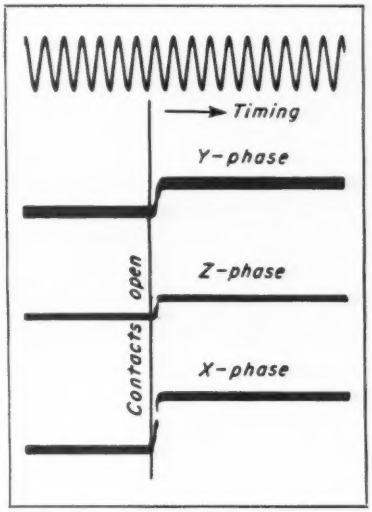
The special instrument tests coordinated performance of various parts of this breaker. It is a pressure recorder constructed as a balanced magnetic bridge with three separate coils wound on an "E" iron core. Combined with this bridge are an electronic oscillator, an amplifier, and an oscillograph. Oscillator output is approximately 1,450 cycles.

In a test operation, the balance beam of the instru-

(Continued on page 110)



CIRCUIT BREAKER PERFORMANCE was recorded on an oscillogram for both opening and closing. Opening time for the Brown-Boveri was 2.8 cycles. Closing time was 5.9 cycles

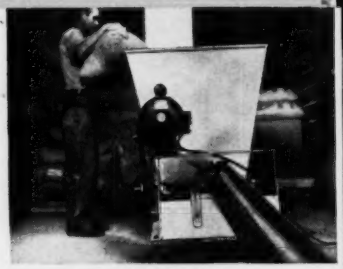


CONTACT COORDINATION for an opening operation is shown for all phases

Urban Transit

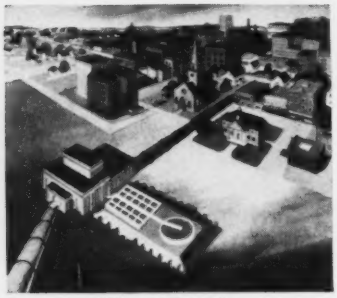
Outdoor Recreation

Barn Hay Curing



Electrified Farming

Sewage Treatment



Water Supply

Farm Water Supply

Farm Welding

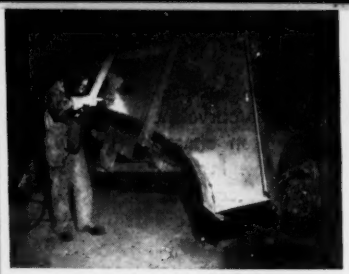
21 dramatic film programs to help you build load, get community action

LATEST ELECTRICAL IDEAS and techniques are dramatically portrayed in the twenty-one film programs shown here. You can use them to build industrial and farm electrification, promote community improvement.

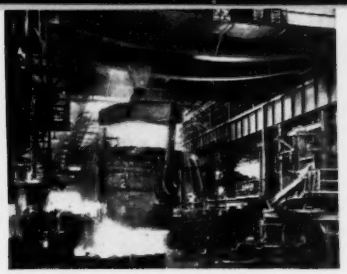
General Electric's "More Power to America" film library is a special series of programs designed to help you increase industrial and farm electrification, promote community improvement, and to stimulate your own public-relations activities. Each of these programs contains an educational motion picture or slidefilm, an authoritative manual, and supplementary literature. Specifically designed for use by the electric utilities, these packaged programs represent the best co-operative thinking of electrical and machinery manufacturers, application and consulting engineers. Non-commercial in nature, these film programs dramatically portray the latest electrical ideas and techniques in the use of electrical power in fields ranging from Materials Handling to Sewage Treatment.

The nation's leading utilities and other organizations are now using over 2000 "More Power to America" programs as vital components of their power sales and community development activities. Utilities of all sizes are placing increasing emphasis on MPA's creative, mass-selling methods. If you would like full details and prices of these film programs—or if you would first like a preview—contact your local G-E Apparatus Sales Office, or mail the coupon to General Electric Co., Schenectady 5, N. Y.

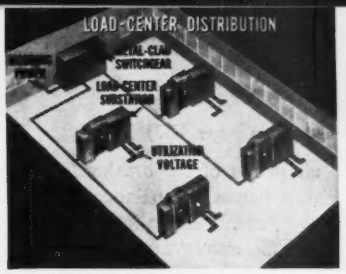
More Power to America



Resistance Welding



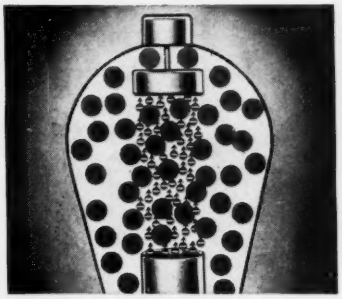
Materials Handling



Industrial Power Distribution

Laundry Electrification

Textiles

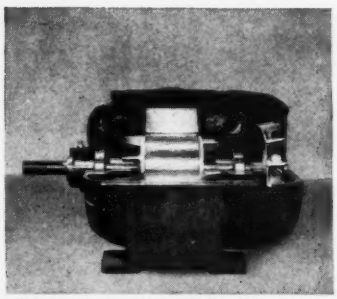


Electronic Training Course

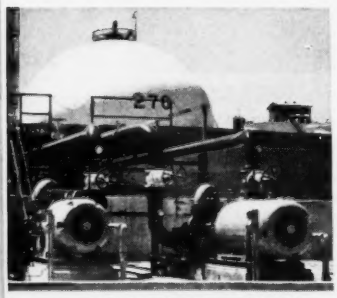
Electric Arc Welding

SEND IN COUPON BELOW

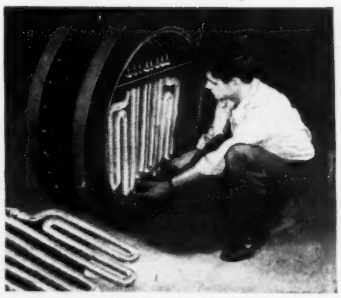
Progressive Mechanization



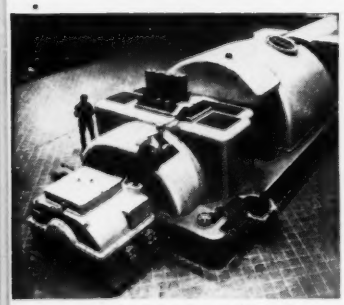
Motor Selection & Application



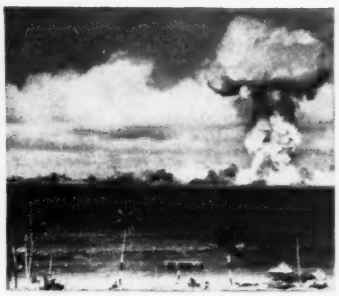
Oil Field Electrification



Industrial Heating



Freedom and Power



Atomic Power

GENERAL ELECTRIC COMPANY
APPARATUS SALES DIV., SEC. A684-3
SCHENECTADY 5, N. Y.

I am interested in the following film programs:

√ **for details and prices** × **on a loan basis**

- ☐ Sewage Treatment (25-minute, 16-mm sound-color motion picture) (GEA-4938-5A)
- ☐ Outdoor Recreation (20-minute, 16-mm, sound, black-and-white motion picture) (GEA-4938-15)
- ☐ Water Supply (25-minute, 16-mm, sound-color motion picture) (GEA-4938-17)
- ☐ Urban Transit (17-minute, 16-mm, sound-color motion picture) (GEA-4938-20)
- ☐ Barn Hay Curing (28-minute, 16-mm, sound-color motion picture) (GEA-5074-1A)
- ☐ Farm Welding (25-minute, 16-mm, sound-color motion picture) (GEA-5074-2)
- ☐ Farm Water Supply (20-minute, 16-mm, sound-color motion picture) (GEA-5074-3)
- ☐ Electrified Farming (20-minute, 16-mm, sound-color motion picture) (GEA-5074-5)
- ☐ Laundry Electrification (30-minute, 35-mm, black-and-white sound slidefilm) GEA-4938-1A)
- ☐ Electronics Training Course (Twelve 20-30-minute, 35-mm, black-and-white sound slidefilm) (GEA-4938-3B)
- ☐ Resistance Welding (30-minute, 16-mm, sound-color motion picture) (GEA-4938-6A)
- ☐ Power Distribution (20-minute, 35-mm,sound-color slidefilm) (GEA-4938-8B)
- ☐ Oil Field Electrification (30-minute, 16-mm, sound-color motion picture (GEA-4938-9A)
- ☐ Materials Handling (24-minute, 16-mm, black-and-white sound motion picture) (GEA-4938-10A)
- ☐ Electric Arc Welding (27-minute, 16-mm, sound-color motion picture) (GEA-4938-11)
- ☐ Textiles (26-minute, 16-mm, sound-color motion picture) (GEA-4938-13)
- ☐ Industrial Heating (30-minute, 35-mm, black-and-white sound slidefilm) (GEA-4938-14)
- ☐ Motor Selection and Application (Ten 10-30-minute, 35-mm, black-and-white sound slidefilm) (GEA-4938-16A)
- ☐ Progressive Mechanization (27-minute, 16-mm, sound-color motion picture) (GEA-4938-18)
- ☐ Freedom and Power (29-minute, 16-mm, sound-color motion picture) (GEA-4938-19)
- ☐ Atomic Power (15-minute, 16-mm, sound-color motion picture) (GEA-4933-22)

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....

GENERAL ELECTRIC

Oscillograph

(*Continued from page* 107)

ment is attached to the air piston of the breaker. As air pressure changes, the piston moves the balance beam to unbalance the air gap at the coils. Voltage induced in the center coil is proportional to the movement of the balance beam.

The amplified and rectified output of the center coil operates the oscillograph element, producing a curve showing amplitude of pressure in the interruption chambers calibrated in psi. Other curves drawn by the instrument show contact opening, opening-closing time, coordinated make and break of the interrupted contacts, and coordination of the air blast relative to contact break and pressure rise in the interrupters.

Sprayed Plastic Masking Facilitates Panel Painting

GLEN HERBST, Test Technician, Dayton Power & Light Co, Dayton, Ohio

Plastic masking sprayed on indicating lights, switch handles, instruments, and nameplates facilities panel board painting. Dayton Power & Light Co found that a far better job can be done with plastic than by other methods. Both "out of service" and "in service" boards have been successfully painted.

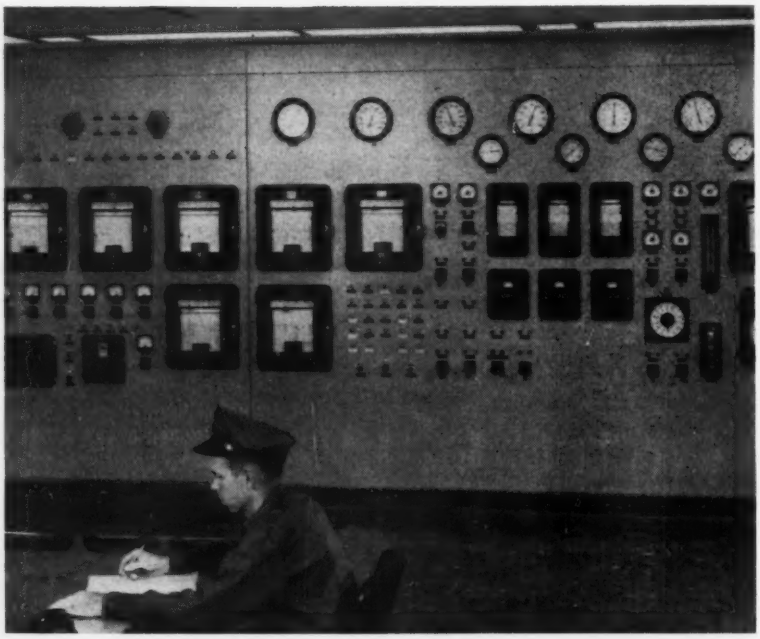
The plastic, similar to that used by manufacturers to protect painted surfaces during shipment, is fluid and resembles buttermilk in color and consistency. After applying, it becomes transparent in 15 to 20 min, sets well in about 2 hours, but is best worked if allowed to set over night. If the plastic is sprayed on too thick, it will run and will not become transparent for one or two hours.

Plastic is best applied with a regular paint spray gun having a No. 765 nozzle and a 2-gal pressure feed tank. The material will not flow properly with a regular suction-type gun. Warm water can be used to clean equipment before the plastic dries.

When spraying, the gun should be moved in a straight line and held 8 to 10 in. away from the work. Operating the gun in a fan motion or arc fogs out the plastic, and it will not go on wet.

Most difficult part of the masking job is that of removing plastic from the surface to be painted without uncovering instruments. This can be done by cutting around components with a small-bladed, sharp knife or model-making knives.

A small wood burning tool with its tip worked down to a thin, fairly sharp point is also useful for trimming plastic. This tool has the advantage of melting through the plastic without requiring sufficient force to dull the edge. Other knives have to be sharpened often so as not to tear the plastic.



INSTRUMENT PANELS were spray painted at the O. H. Hutchings Station while boards were in service by using sprayed plastic masking and cellophane instrument covers

Experimental masking work was done at the Frank M. Tait Station where a hydrogen panel board for a high-pressure topping unit was out of service. The board was sanded and cleaned; components were masked with plastic. A glossy paint was applied and allowed to dry overnight. Plastic coverings were then removed with little effort. The masking job was found to be superior to that obtained by conventional methods.

Painting panel boards that were in service at the O. H. Hutchings Station was then undertaken. Greatest concern was that of keeping important instruments visible as much as possible. Because of the plastic's transparency characteristics, two coats of plastic, producing a 0.003-in. thickness, were applied. Plastic on the surface to be painted was removed, leaving instruments masked.

Faces of important instruments were then covered with cellophane; no effort was made to obtain complete coverage. An undercoat was sprayed on the panel, and cellophane was immediately removed. This enabled the operator to see instruments and keep the boiler and turbine operating properly.

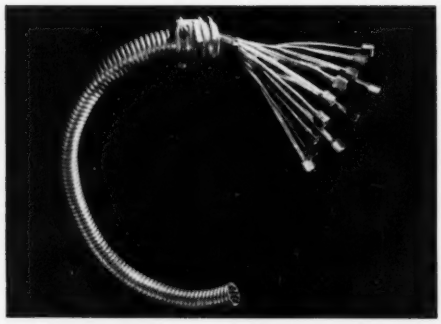
Next, the equivalent of three coats of lacquer was sprayed on boards and instruments. After 3 to 5-min drying time, the lacquer covered plastic masking was removed from instrument faces. Other components were then unmasked.

Complete painting job on the control room panel boards for two turbine-boiler units required 355 man-hours. With this experience, painting of future panels, with the exact shade to the company's standard color, will take less time.

For the new pneumatic instrumentation

Cabled Tube

The recent tremendous increase in the use of tube instead of wires for instrumentation and control purposes has led to an important new development—cabled tube. This is an armored group of long tubes twisted together to permit bending without distortion. An insulating tape is wrapped over the bundle of tubes to prevent electrolytic action. Then interlocking, flexible galvanized steel armor is applied, like BX. This protetts the tubes from injury during shipment, storage, installation, and in service. Standard fittings, boxes and cabinets can be used for junction boxes and terminations. To make it possible to readily identify each tube, one tube in each layer is colored; the position of each tube in each layer in relation to the coded tube

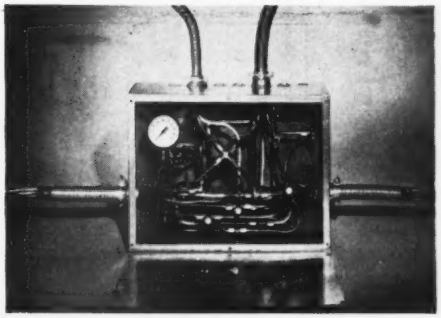


remains the same throughout the length of the cable.

The tubes usually are copper, but aluminum tubes can be used for special purposes. For unusually corrosive situations, a plastic outer sheath can be applied. As many as 19 tubes, ¼" OD, can be cabled, and supplied in lengths up to 1,000 ft.

Showing the construction of Crescent Armored Multitube, made by Crescent Insulated Wire and Cable Co., Trenton 5, N. J., which will supply further information on request.

Since the tubes carry not electricity but air, nitrogen, helium, or a fluid, they are especially attractive in potentially explosive locations, as in refineries and chemical plants. Utilities are also turning decisively to this new cable, while automatic process control (automation) is a rising application.



Revere, as a supplier of tube for this purpose, calls this cabled tube development to your attention as a matter of general and perhaps specific interest. See Revere for copper, aluminum and brass tube and pipe, electric welded steel tube, and lockseam tube. Call the nearest Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere

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ON NBC TELEVISION, SUNDAYS

Standard Ratings for Transformers

Single-Phase, Distribution, Overhead Type

500 kva and Smaller; High Voltage—67 kv and Below; Low Voltage—15 kv and Below

Preferred Nominal System Voltage	Transformer High Voltage Rating	High-Voltage Taps Above	High-Voltage Taps Below	Standard Kva Ratings for Low-Voltage Ratings of: (a) 120/240 (b)	240/120 (c)	240/480 (b)	240x480 (d)	600	2,400 or 4,800	2,520 or 5,040	6,900	7,200 7,560 7,980
480	480	None	2-5%	3-100	——	——	——	——	——	——	——	——
600	600	None	2-5%	3-100	——	——	——	——	——	——	——	——
2,400 or 2,400/4,160Y	2,400	None	None	3-50	——	——	——	——	——	——	——	——
		None	4-2½%	3-167	——	——	——	——	——	——	——	——
		2-2½%	2-2½%	——	250-500	10-100	167-500	25, 50, 100 167, 333, 500	——	——	——	——
2,400/4,160Y	4,160	None	4-2½%	3-100	——	——	——	——	——	——	——	——
		2-2½%	2-2½%	——	——	10-100	——	——	——	——	——	——
4,800 or 4,800/8,320Y	4,800	None	None	3-50	——	——	——	——	——	——	——	——
		None	4-2½%	3-167	——	——	——	——	——	——	——	——
		2-2½%	2-2½%	——	250-500	10-100	167-500	25, 50, 100 167, 333, 500	——	——	——	——
2,400 or 2,400/4,160Y or 4,800 or 4,800/8,320Y	2,400x4,800(d)	None	None	3-100	——	10-100	——	25, 50, 100	——	——	——	——
		None	2-5%x4-2½%	167	——	——	——	——	——	——	——	——
		1-5%x2-2½%	1-5%x2-2½%	——	250-500	——	167-500	167, 333, 500	——	——	——	——
7,200 or 7,200/12,470Y	7,200	None	4-2½%	3-167	——	——	——	——	——	——	——	——
		2-2½%	2-2½%	——	250-500	10-100	167-500	25, 50, 100 167, 333, 500	50, 100-500	333, 500	——	——
7,200/12,470Y	12,470GrdY/7,200(e)	None	None	3-5	——	——	——	——	——	——	——	——
		None	4-2½%	3-50	——	——	——	——	——	——	——	——
7,620/13,200Y	7,620	2-2½%	2-2½%	3-167	250-500	10-100	167-500	25, 50, 100 167, 333, 500	——	——	——	——
7,620/13,200Y	13,200GrdY/7,620(e)	None	None	3-5	——	——	——	——	——	——	——	——
		2-2½%	2-2½%	3-50	——	——	——	——	——	——	——	——
12,000	12,000	None	4-2½%	3-167	——	10-100(h)	167-500(h)	——	——	——	——	——
		2-2½%	2-2½%	——	250-500	10-100	167-500	25, 50, 100 167, 333, 500	50, 100-500	333, 500	——	——
13,200	13,200	None	4-2½%	37½-167	——	——	——	——	——	——	——	——
		2-2½%	2-2½%	——	250-500	——	167-500	167, 333, 500	167-500	333, 500	——	——
14,400	13,800	14,400/14,100	13,500/13,200	167	250-500	——	167-500	167, 333, 500	167-500	333, 500	——	——
13,200 or 14,400	13,200(f)	14,400/13,800	12,870/12,540(g)	3-100	——	10-100	——	25, 50, 100	50, 100	——	——	——
13,280/23,000Y	22,860GrdY/13,200(e)	14,400/13,800	12,870/12,540(g)	3-50	——	——	——	——	——	——	——	——
23,000	22,900	24,100/23,500	22,300/21,700	25, 100	——	25, 50, 100	167, 333 500	100, 167 333, 500	100, 167 333, 500	333, 500	333, 500	167, 333 500
34,500	34,400	36,200/35,300	33,500/32,600	25, 100	——	25, 50, 100	167, 333 500	167, 333, 500	167, 333 500	333, 500	333, 500	167, 333 500
46,000	43,800	46,200/45,000	42,600/41,400	50, 100	——	50, 100	167, 333 500	167, 333, 500	167, 333 500	333, 500	333, 500	167, 333 500
69,000	67,000	70,600/68,800	65,200/63,400	100	——	100	167, 333 500	——	167, 333 500	333, 500	333, 500	167, 333 500

(a) STANDARD KVA RATINGS ARE: 3, 5, 10, 15, 25, 37½, 50, 75, 100, 167, 250, 333, 500. Kva ratings separated by a dash(–) indicate that all intervening standard ratings are included. Kva ratings separated by commas indicate that only those listed are standard ratings.

(b) Low-voltage rating of 120/240 v or 240/480 v is suitable for series, multiple, or three-wire service.

(c) Low-voltage rating 240/120 v indicates that the transformer shall be suitable for series or three-wire operation but not for multiple operation at 120 v.

(d) Low-voltage rating 240x480 v or high-voltage rating 2,400x4,800 v is suitable for series of multiple service but not for three-wire service.

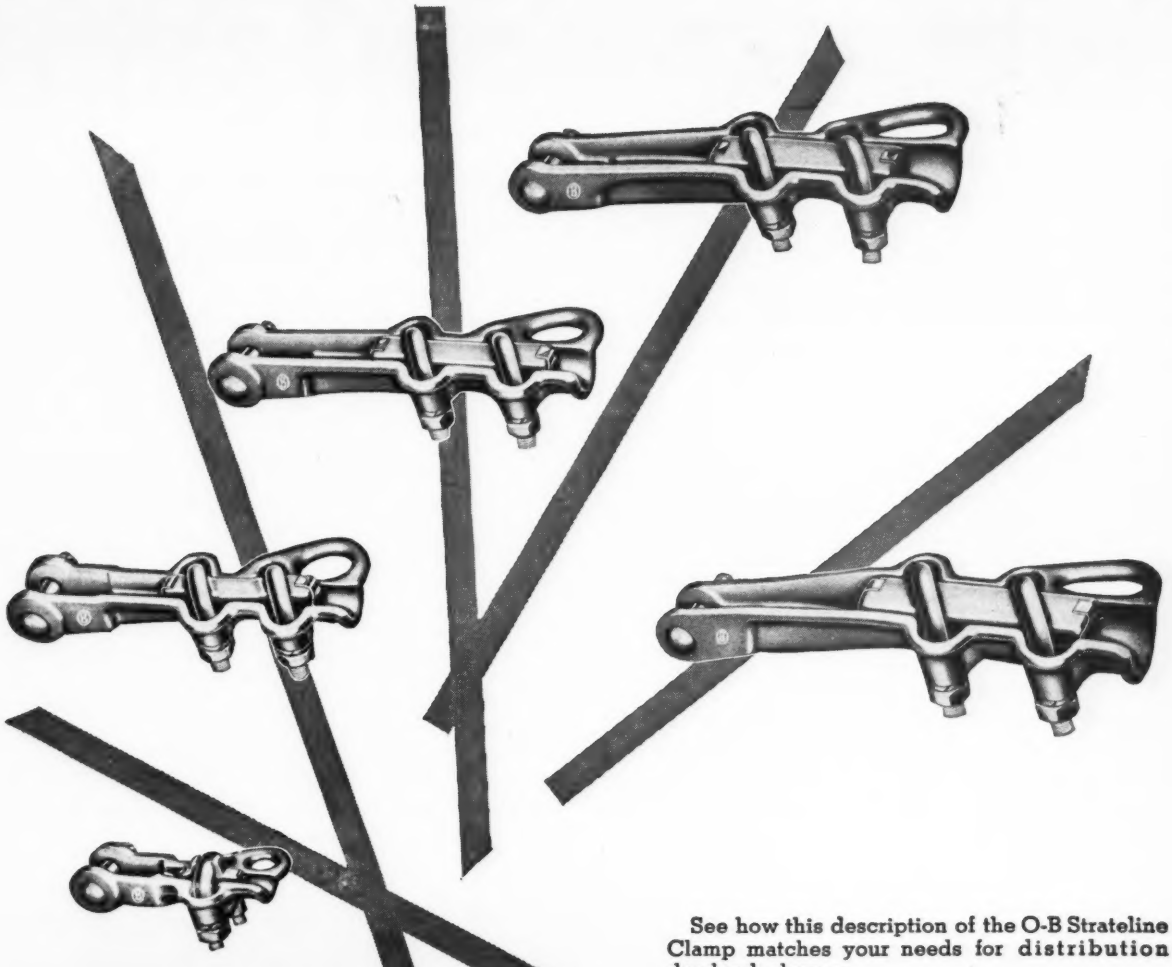
(e) One high-voltage bushing only.

(f) Transformers in this class are designed to cover in one rating the general voltage range 13,000–15,000 v.

(g) The lowest voltage shall be reduced kva rating. All others shall be at rated kva.

(h) These transformers are included for specific applications where 2-2½% taps above and 2-2½% taps below are not considered suitable.

Adapted from EEI Publication No. 53-1 and NEMA Publication No. 114-1953



O-B STRATELINE MADE-TO-ORDER FOR PRIMARY DEADENDS

See how this description of the O-B Strateline Clamp matches your needs for distribution deadend clamps:

1. Made of bronze, aluminum or malleable iron for proper clamp-conductor combination.
2. Five clamp sizes cover 0.15 - 1.55 inch range.
3. Slip strength three times greater than usual maximum conductor tension.
4. Cost in keeping with balance of distribution construction.
5. Sized and shaped for safe clearances in close phase spacing.
6. Dependability proved by years of service experience.

Here, then, is a clamp design that is nicely suited to the close clearances and strength requirements of distribution line work, at a price consistant with that class of work. After a trial order, we're sure that O-B Stratelines will be on your standards list!

Ohio Brass

MANSFIELD OHIO, U.S.A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

4401-M

ROPE GUIDE attaches to rack base and spindle, and facilitates jobs where rope and blocks are used when working secondaries

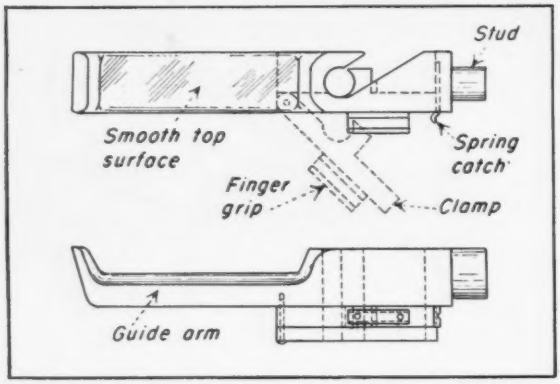
Detachable Guide Reduces Rope Wear

A rope guide to aid pulling secondary wires through racks has been developed and patented by Joseph Truchon, line foreman, United Illuminating Co, Bridgeport, Conn. The guide provides a suitable support for a block and tackle, reduces rope wear, and eliminates short tie ropes that clutter the working space and cause binding.

Formerly, short pieces of rope were used to support blocks. Rope was also used to support the line that the groundman pulls. Sometimes, the latter line was draped across the secondary rack's top. These methods were cumbersome, inefficient, and caused excessive rope wear.

The rope guide solved these problems. It is easily mounted in and removed from the secondary bracket. When in position, the guide is attached to the rack spindle by a clamp that is held closed by a spring catch. The clamp's outer side is provided with a finger grip to release the latch.

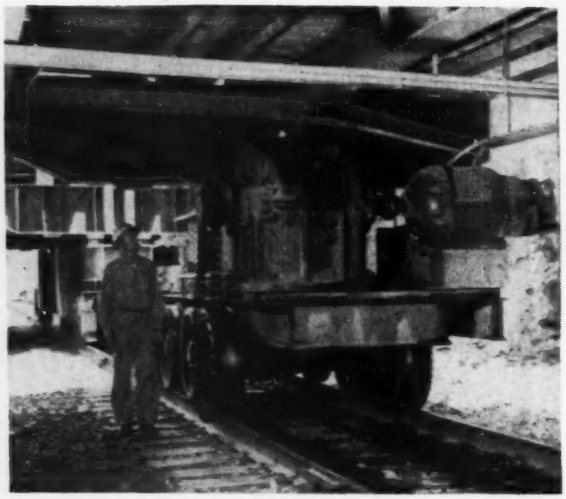
For drawing up a secondary wire the ropes pass over the smooth rounded upper surface of the guide's projecting arm. This smooth surface permits the ropes to move freely without being cut or ravelled.



GUIDE DETAIL shows how catch mechanism closes to hold spindle of rack. Stud on end of guide fits into the slot in the rack's base

General Electric Co

CONCRETE BUCKET on cable way is visible to operator in control station, near head towers. Tail tower is on other side of the dam



HEAD TOWER TRUCKS moved tower along two parallel 340-ft long tracks. Two of the four trucks were driven by 75-hp motors

Cableway Places Concrete, Sets Record

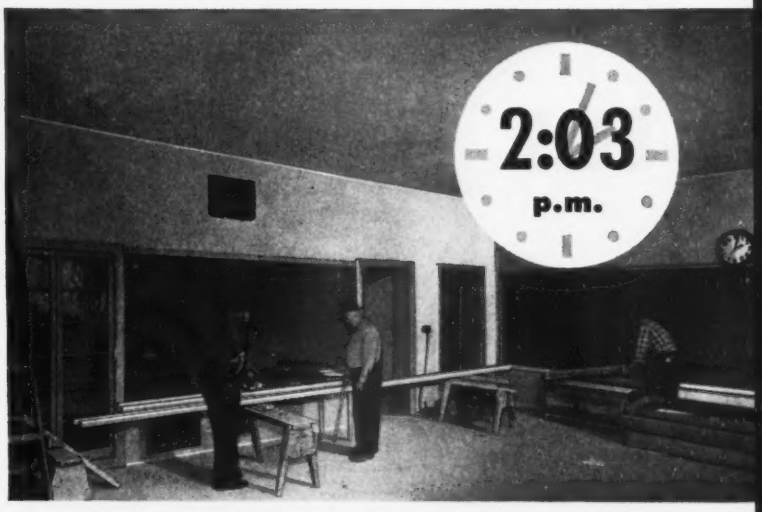
Thanks to the world's fastest cableway, the eighth highest dam in the world, the 440-ft Pine Flat Dam across California's Kings River, is rapidly nearing completion ahead of schedule.

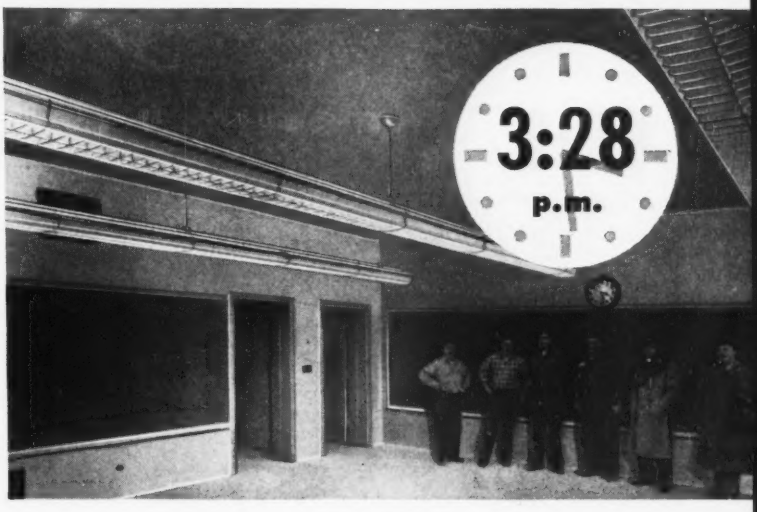
The cableway operated at a maximum rope speed of more than 2,000 fpm over the 2,400-ft span between its head and tail towers. It utilized an 8-cu yd bucket containing 17½ tons of 50-degree concrete and placed more than 4,000 cu yd in one 24-hour period.

(Continued on page 118)

Lighting Completely Installed

in 85 minutes!





costs cut 27% with UNISTRUT® channel and fittings

New fluorescent lighting was recently installed in 18 classrooms at Lincoln School, Eau Claire, Wisconsin, in record time at a huge savings in cost over conventional methods. "Before and after" photos prove how fast the job was done. In first photo fixtures are just being unpacked at 2:03 p.m. At 3:28 p.m. second photo shows installation of three 24 ft. rows completed, room cleaned, tools and accessories moved to next room for installation there. Total time 85 minutes.

This job* is just one of hundreds where the UNISTRUT system has helped produce the maximum in lighting efficiency while saving installation time and money.

PERFECT ALIGNMENT
UNISTRUT channel is rigid, straight and strong—gives true alignment that servicing can't disturb.

ADDED SAFETY
UNISTRUT installations are safer. Continuous row becomes a single integrated unit—weight is equally distributed along all suspension points.

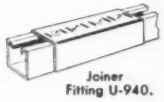
COMPLETE FLEXIBILITY
UNISTRUT installations are made in spite of ceiling irregularities. Stems can be attached at *any* point along channel.

LOW COST
The UNISTRUT system is quickly, easily erected. Saves costly installation time—permits wiring to be done at working level. Fewer hanger rods are needed. Approved as wireway in Chicago and more than 20 major cities.

It'll pay you to find out how the UNISTRUT system will help solve your lighting installation problem—*faster, better, at lower cost.* Contact your nearest UNISTRUT distributor or dealer today—he's listed in your telephone directory.

*Garden City Plating Company, Chicago, Ill. Fluorescent Fixtures.
E. F. Klingler & Associates, Eau Claire, Wis. Architects and Engineers.
Roshell Electric Service, Chippewa Falls, Wis. Electrical Contractor.

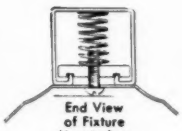
Snap-in Closer Strip.

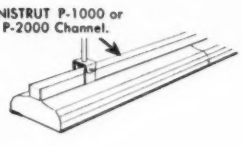

Joiner Fitting U-940.

Hanger Fitting P-2335.

Write today for free Fluorescent Lighting Bulletin FF-3

U. S. Patent Numbers
2327587 2329815 2345650
2363382 2380379 2405631
2541908 Other Patents Pending


End View of Fixture Mounted on UNISTRUT Channel.



Catalog in Sweet's 1953 Architectural, Plant Engineering and Industrial Construction Files.

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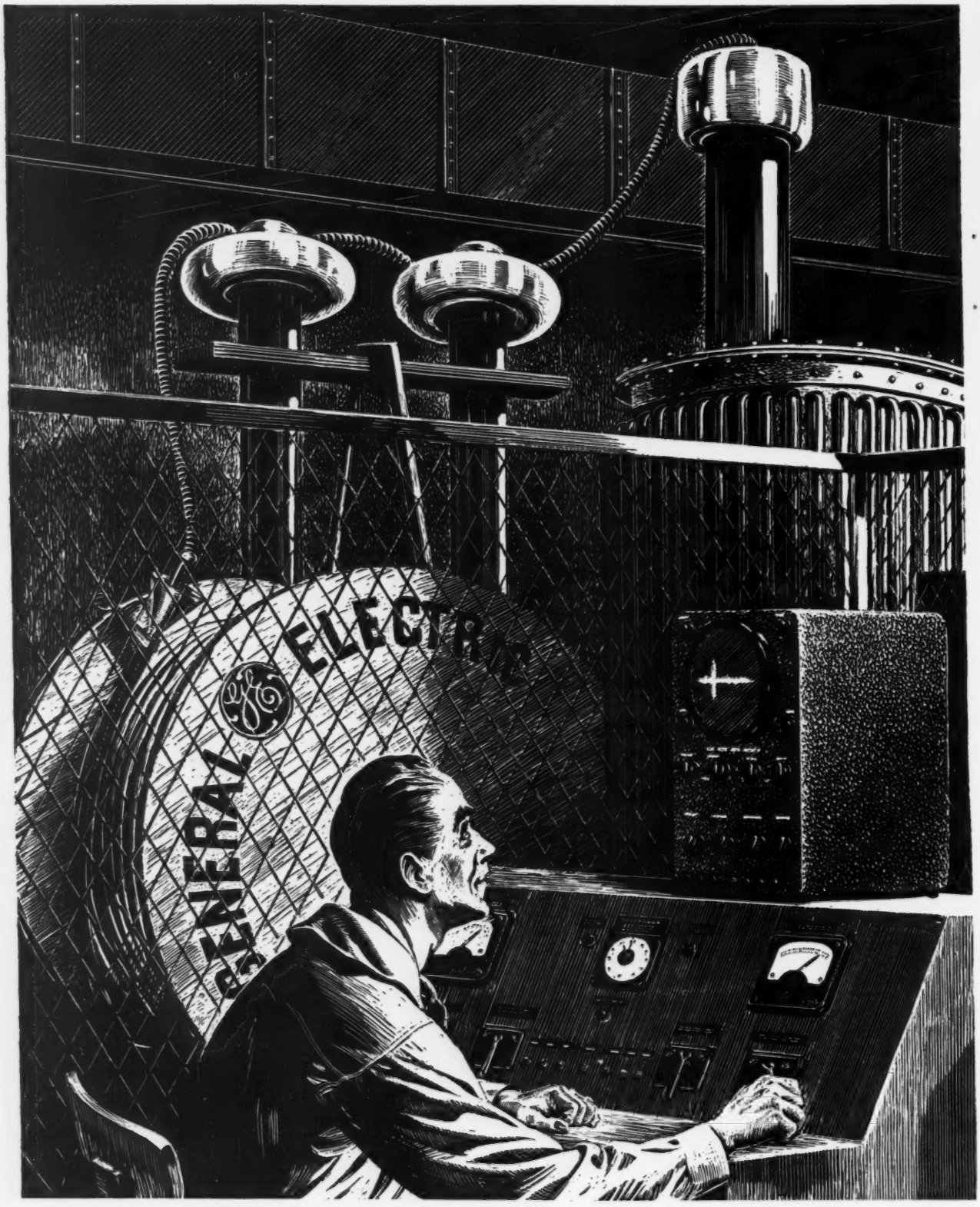
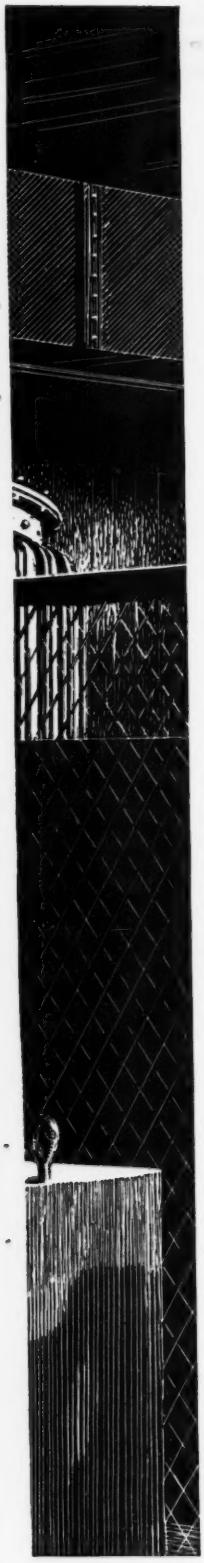


G-E Wire and Cable engineers have access to this ionization testing equipment at General Electric's High-voltage Laboratory in Pittsfield, Massachusetts. This equipment and other facilities in other departments of the Company help G-E engineers speed the development of new and better wire and cable.



General Electric's company-wide research and test facilities give you...

Cables that you know will meet your needs

Producing wire and cable to meet your requirements calls for both production-line test equipment and specialized test and research facilities. Because the General Electric Company manufactures an extensive line of electrical apparatus, it has a full range of specialized test and research facilities readily available to provide basic data necessary for the solution of many cable problems. G-E wire and cable engineers use this data to maintain continuing progress in the design and manufacture of wire and cable.

Production-line Testing

All equipment necessary for thorough production-line testing is available at the Wire and Cable Department in Bridgeport, Connecticut. Typical of this equipment are Schering Bridge test apparatus for power-factor and ionization-factor testing, apparatus for measuring insulation strength and conductor resistance, and one of the few ionization testers that can handle regular production lengths of cable—in lengths exceeding 3000 feet.

Continuing Research and Development

But even the best production-line testing isn't enough. New demands in utility systems are constantly developing with resulting new demands on wire and cable. This calls for continuing research and development. As an example, use is made of the General Electric High-Voltage laboratory at Pittsfield, Mass., to test impulse voltage break-down levels — in order to coordinate the insulation level of the cable with that of the other equipment in your system. At the present time G-E engineers are exploring this subject with higher-voltage Super Coronol* cable to increase reliability in service.

If the problem is high currents, the G-E Switchgear Development Laboratory in Philadelphia can test cable performance under short circuits of practically any magnitude. Other equipment at Pittsfield can simulate high-current surges of intensities up to that of natural lightning.

This testing and research program gives General Electric engineers the data necessary to predict cable performance, to design better cables that you *know* will meet your needs, and to learn more about how to use and protect cables in service. These are a few of the reasons why it's a good idea to call your General Electric wire and cable specialist whenever you have a cable problem. Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

**Registered Trade-mark General Electric Company*

You can put your confidence in—

GENERAL ELECTRIC

Cableway

(Continued from page 114)

Cableway's high speed was made possible by these factors:

1. Use of dc power.

2. Separate drives that enable it to hoist and haul simultaneously.

3. And a control system for smooth, positive operation.

Separate amplidyne-controlled, adjustable-speed drives operate hoist and haul drums. Each drive consists of two 400-hp dc motors. These received power from a MG set made up of two 300-kw shunt-wound generators driven by a 900-hp synchronous motor. Main-drive motors featured two-shoe magnetic braking.

Head and tail towers were each propelled on straight, parallel tracks by two 75-hp wound rotor motors. A selsyn arrangement served as an automatic skew control to keep the two towers aligned at all times. Because the cableway and a slower service rig operated on common tracks, a photoelectric control was used to prevent the two systems' towers from colliding.

Control station for the high-speed rig was located in an enclosed platform jutting out from the batch plant, on one side of the 2,240-ft canyon. Good visibility from this elevated location enabled operator to control the cableway without signals most of the time.

Pine Flat Dam, containing 2,200,000-cu-yd of concrete, will use its reservoir storage of 1,000,000 acre-ft to control flood waters. At the end of flood season storage will be used for irrigation and hydroelectric power generation.

Jig Facilitates Servicing Automatic Line Reclosers

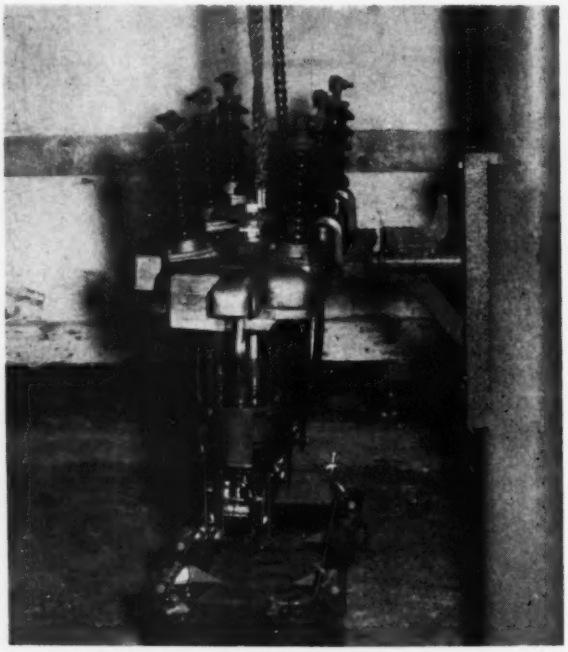
ALFRED A. DAVIS, Distribution Dept, Atlantic City Electric Co, Atlantic City, N. J.

A local-made jig enables servicing of automatic line reclosers with minimum risk to the recloser in about ⅔ the time previously required. In addition, the recloser mechanism can be rotated to any of four positions that best facilitates replacement of any part, and returned immediately to the upright position for reentry to the tank.

Jig components were obtained from a scrap line and assembled by welding. Parts consist of a base attached to a vertical support; a horizontal bearing with an angular support underneath and a sliding key on top; and a two-prong rack attached to a shaft with a four-notched disk to hold the rack and recloser mechanism at 90, 180, 270 or 360-deg positions.

For use, the jig is attached ordinarily to a column and the rack placed horizontally. A hoist lifts the recloser head and oil-immersed mechanism from its tank and the head is secured to the rack by two bolts screwed into tapped holes, available for the lifting eyes. The tank is removed from underneath the mechanism, cleaned and refilled. The mechanism is flushed, inspected, repaired lowered into its tank, secured and ready for final test.

Since the jig weighs approximately 25 lb, it is easily transported and may be installed on a shop wall, vertical beam, or the base of a pole if service work is necessitated in the field. With different adaptor bars, other equipment can be serviced with equal ease and safety.



COLUMN-MOUNTED JIG supports line recloser head and mechanism after being raised by hoist, and permits rotation to facilitate inspection and replacement of parts

Test Socket Takes Five Different Thermal Meters

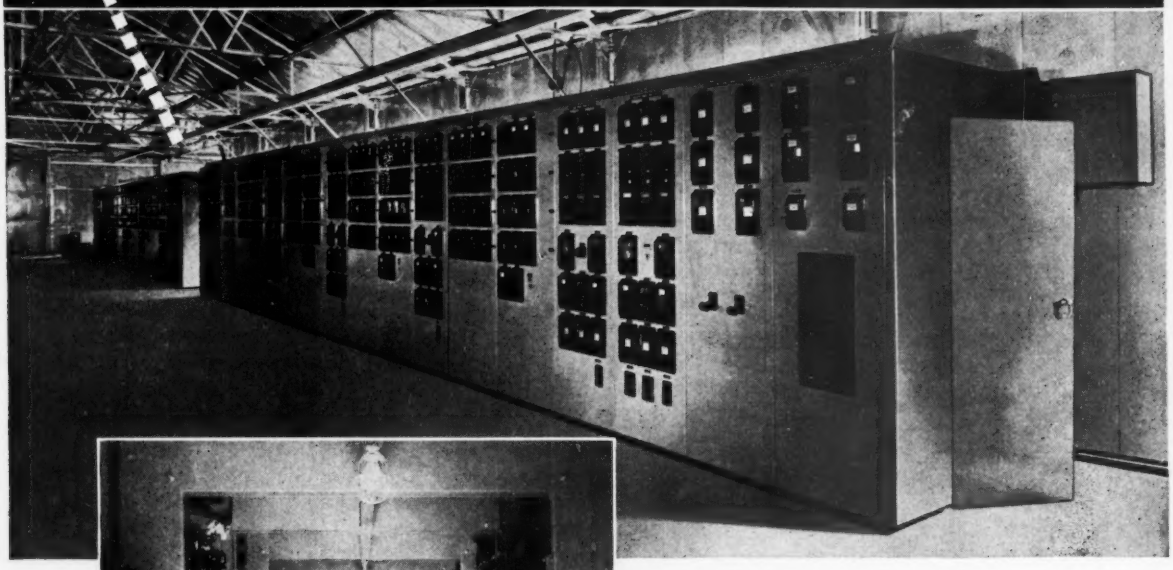
MERLE H. BOWMAN, Meter Supt
A. L. GAENICKE, Technical Meterman,
Sacramento Municipal Utility District,
Sacramento, Calif.

Five different types of thermal demand meters can be mounted for gang-testing in a universal socket devised by Sacramento Municipal Utility District. Socket may be hung on commercial testing board and is suitable for testing 4-prong (single-phase); 5-prong, 7-prong and 8-prong (all two-element, three-phase); and 13-prong (three-element, three-phase) meters.

Heart of socket is 13-point bakelite block, mounted in an aluminum indoor meter connection box that measures about 8 x 10 x 3¼ in. Center section of this block has been undercut about ¼ in. between top and bottom current jaws to provide clearance for link blocks on single-phase meters. Two small holes have been drilled in undercut area to take brass contact pins. These pins serve to connect link circuit on single-phase self-contained meters and polyphase delta meters.

(Continued on page 122)

NELSON DUPLEX SWITCHBOARDS
offer many desirable features



Manufactured in two sections, this duplex control and relay switchboard is shown on factory assembly floor.

Interior of one section of the above switchboard is illustrated at left.

NELSON Duplex Control and Relay Switchboards are designed for metering, instrumentation and control of substations and generating stations.

Custom-built to each customer's specifications, these tunnel-type structures achieve utmost simplicity of inter-wiring and cross-panel wiring. They are sturdy in construction and provide maximum accessibility.

Wire guttering can be furnished with or without covers. Wiring on the rear of the panels is secured by flash welded studs in order to assure a smooth front surface.

When you need switchboards of this type, permit us to quote on your requirements.

Observe attractive appearance of this NELSON duplex switchboard.

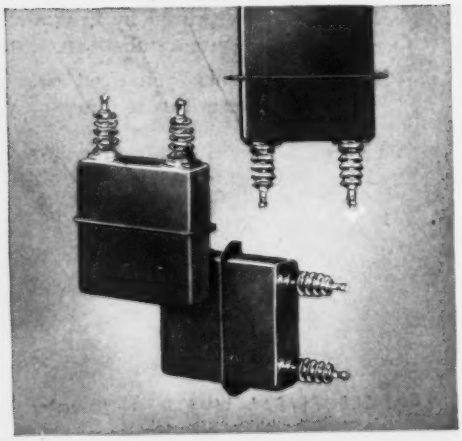
NELSON Electric MANUFACTURING CO.
TULSA, OKLAHOMA

217 N. DETROIT AVE. **TELEPHONE 2-5131**

CAPACITORS

MOUNT IN ANY POSITION

Complete air evacuation assures high dielectric strength



GENERAL ELECTRIC CAPACITORS ARE SMALLER, LIGHTER—MORE DEPENDABLE

Only 66 pounds for 25 kilovar, 2400-volt unit— saves weight on your poles—no sacrifice in quality

When installing capacitors you want dependability . . . plus ease of handling and installation. You get all three with General Electric Pyranol* capacitors.

RECENT TESTS ON G-E CAPACITORS manufactured in 1931, compared with original test records, reveal no change in electrical characteristics. Control of all materials used in construction provides this stability—for example, the dry-annealed aluminum foil used in G-E capacitors is thoroughly cleaned to remove oil and any contaminants. Complete evacuation prior to impregnation removes all air which could cause failure in service. Testing of each unit at every manufacturing stage assures control of quality and gives you a capacitor that will perform longer under the most severe service.

Easier installation is possible with lighter, smaller G-E capacitors. This reduction in size and weight is achieved with no sacrifice in quality.

*Registered trade-mark of General Electric Company.

Remember, whether you need to increase kw capacity of feeders, transformers, regulators, or the entire system back to the generators . . . whether you want to improve feeder voltage levels . . . reduce overall losses . . . or defer the expense of major changes in feeder layout, General Electric Pyranol capacitors are the practical low-cost solution.

Capacitors are the only items of major electrical equipment that cost less today than in 1940. No other electrical investment does so much for so little.

Why not investigate the values of G-E Pyranol capacitors today? Contact your G-E Apparatus Sales Representative or write General Electric Company, Section 441-7, Schenectady 5, New York.

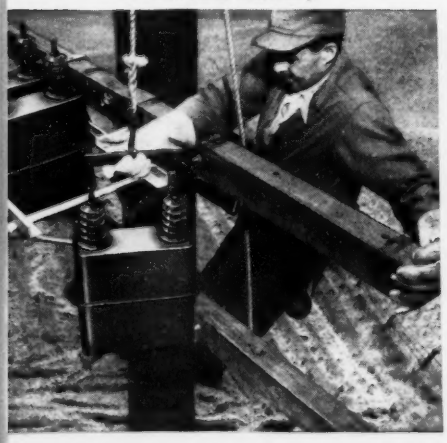
1878 75 1953 YEARS OF ELECTRICAL PROGRESS

Progress is our most important product

GENERAL ELECTRIC

SMALLEST AND LIGHTEST

Easier to handle and install —unexcelled reliability

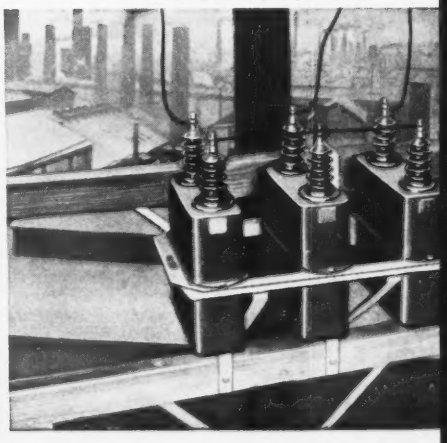


WELDED GLASS BUSHINGS

Provide high mechanical strength— permanent hermetic seal

TRIPLE-PROTECTED CASE

Protects even in corrosive atmosphere —cuts repainting expense



what's NEW in Engineering

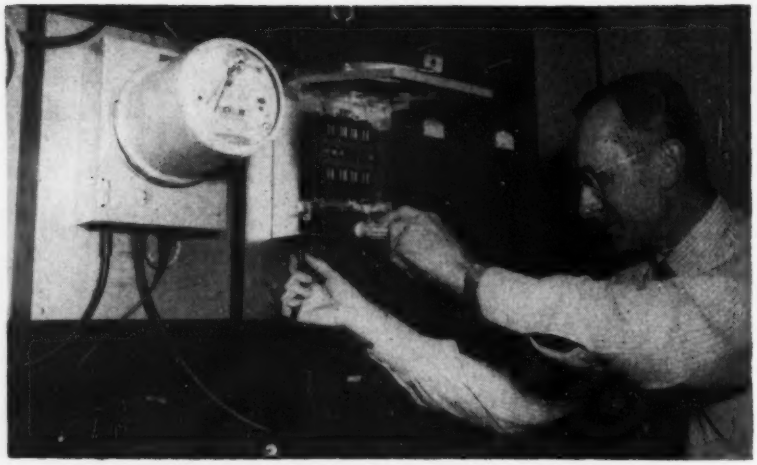
A synthetic soil conditioner has been announced which helps to control rain and wind erosion on construction sites, levees, rights of way and similar "bare ground" sites. Designed to stabilize aggregates on the soil surface, it helps to hold seeds and soil in place until vegetation cover takes over the job.

Deep-sea divers joined a small army of engineers and construction crews in driving over 42,000 piles at a riverside site for a Louisiana plant—to provide a stable foundation in mushy ground. Divers, working 40 feet down in the Mississippi River, were required to direct

placement of the concrete seal. We'll send you a 32-page illustrated book which tells how Kaiser Engineers is equipped to meet challenging problems—like this one at the nation's largest aluminum plant, which was producing metal in just 10 months.

A pocket pyrometer, now on the market, gives direct reading of temperatures up to 3,300 deg. F. Only six and one-half inches long, it weighs about five ounces, and is shaped like a miniature telescope.

Whether it's designing an oil refinery, building a porcelain enameling plant or laying out a site plan, Kaiser Engineers undertakes the job with assurance because of the variety of talent within the organization. Successful experience in a wide field of design, engineering and construction tells the story. Call or write: Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.



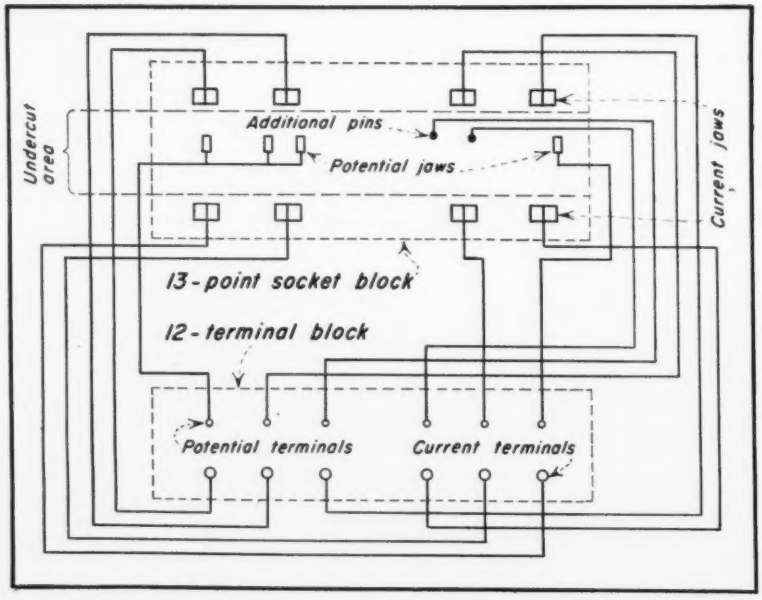
UNIVERSAL SOCKET for gang-testing thermal demand meters takes five types of meters. Sealing ring holds heavier meters to socket

The bakelite block is connected to 12-terminal meter terminal block as shown in accompanying circuit diagram. SMUD found that a terminal block from a type A Westinghouse three-element transformer type meter was best suited for this application. In making current connections. No. 6 or 8 wire should be used to provide ample capacity.

To mount the terminal block, it was necessary to cut a rectangular hole in the bottom of the connection box. Another hole was cut in the cover and an aluminum ring socket mounted over it. A standard meter sealing ring is used to hold meters, especially the heavier types, on this socket.

In operation, connections from test board are made to the terminal board of universal socket. Then a meter is inserted in the socket. In making test connections, it is necessary to lift box cover so that screws may be tightened in terminal board. Based on experience with this type of box, authors would prefer a box with cover opening to the side. Another alternative would be to cut a hole in the lower part of the cover so that terminal block is accessible directly.

(Continued on page 131)



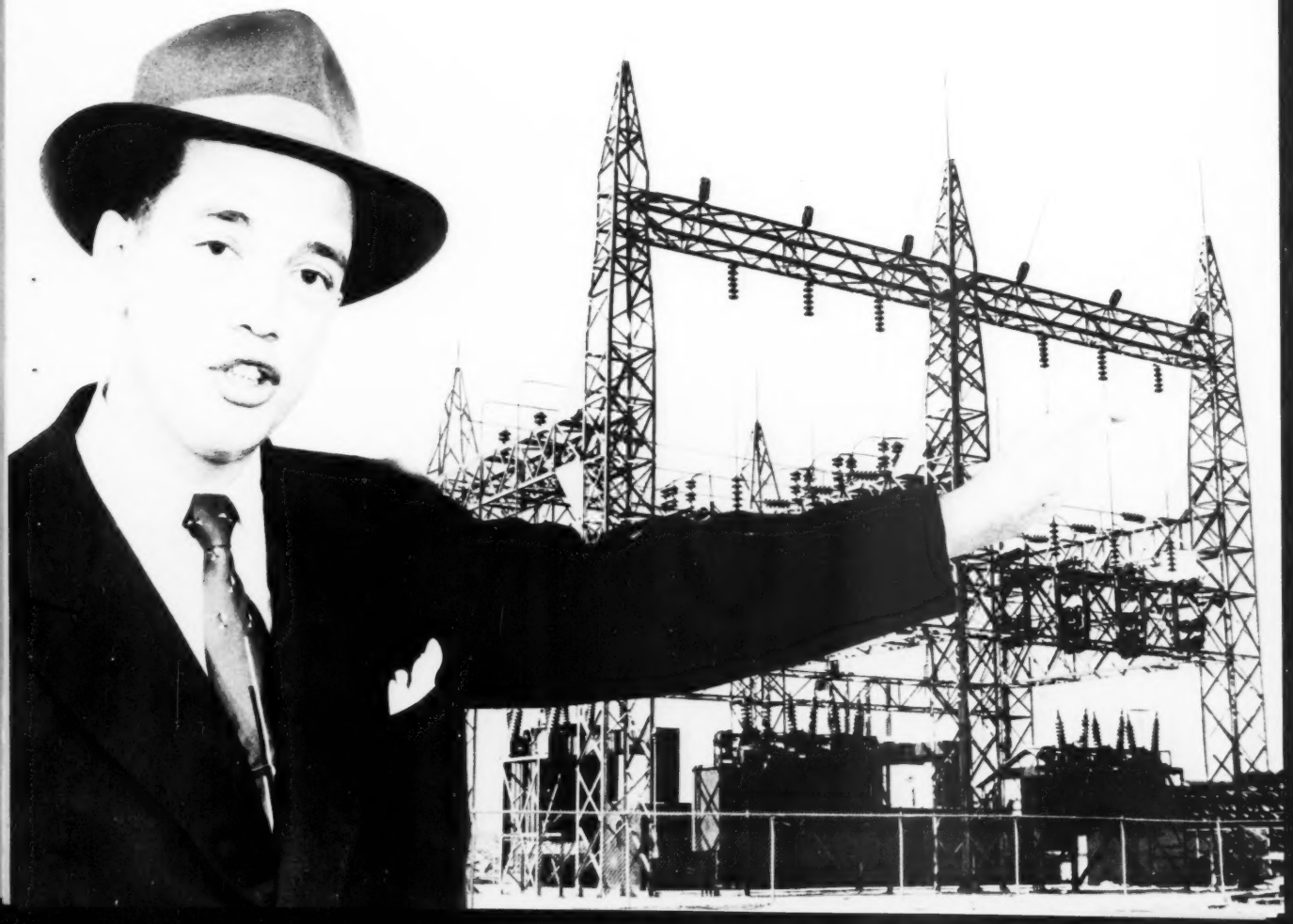
SOCKET BLOCK with 13 points is wired to 12-terminal block. Larger terminals for current leads should be wired with No. 6 or 8 wire

Meet C. L. Wagner,

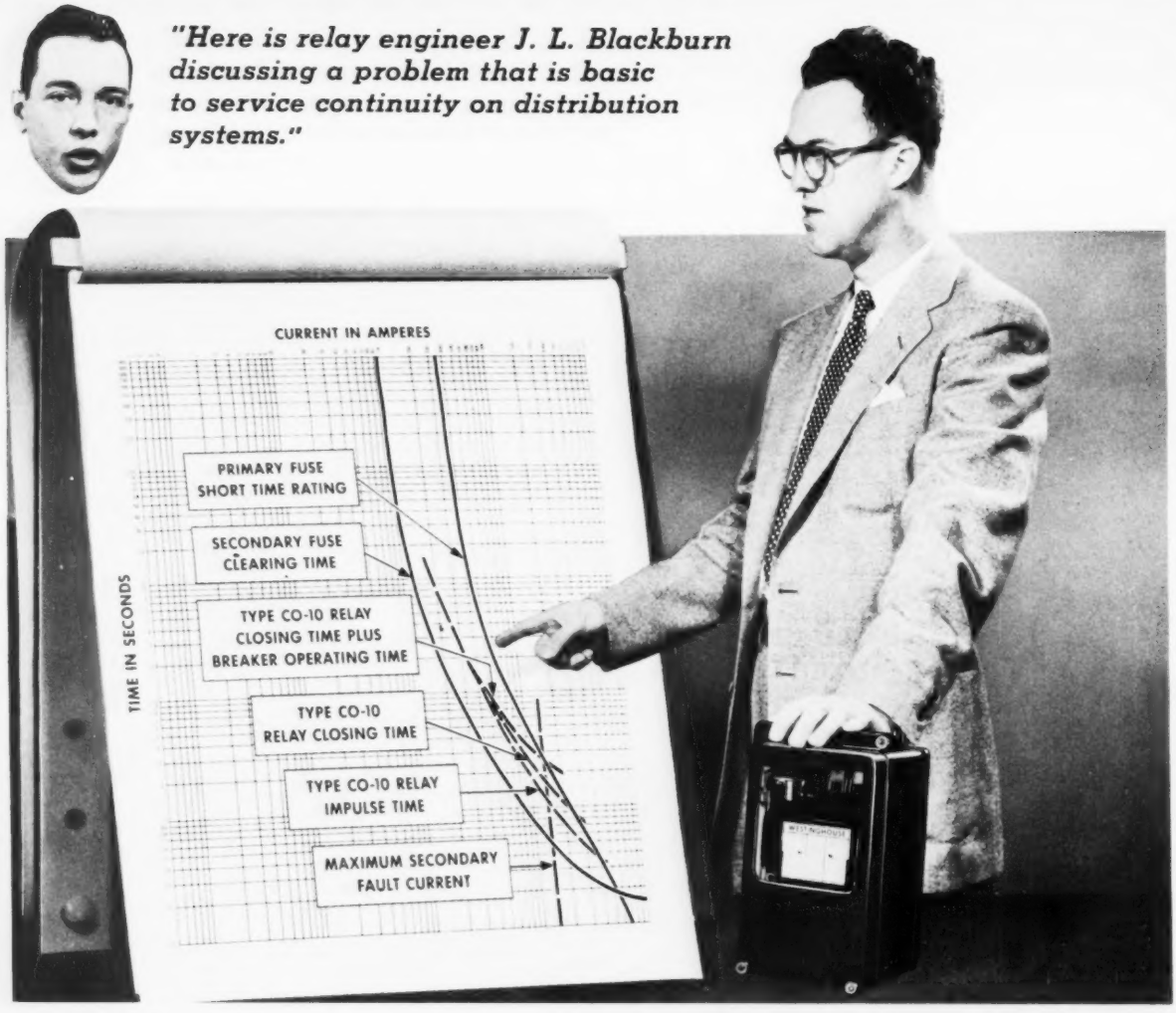
**Westinghouse Electric Utility Engineer.
On the following pages he
leads some discussions on . . .**

Practical service continuity throughout your distribution system

Chuck Wagner acts as liaison between headquarters engineering groups and our district engineers. He handles all kinds of utility problems. Here, Chuck shows how Westinghouse equipment helps you achieve a higher degree of service continuity on your distribution system at a practical economic level.



"Here is relay engineer J. L. Blackburn discussing a problem that is basic to service continuity on distribution systems."


CURRENT IN AMPERES
TIME IN SECONDS
PRIMARY FUSE SHORT TIME RATING
SECONDARY FUSE CLEARING TIME
TYPE CO-10 RELAY CLOSING TIME PLUS BREAKER OPERATING TIME
TYPE CO-10 RELAY CLOSING TIME
TYPE CO-10 RELAY IMPULSE TIME
MAXIMUM SECONDARY FAULT CURRENT

This overcurrent relay gives you perfect coordination with fuses

The Westinghouse CO-10 relay can solve the problem of coordinating overcurrent relays with fuses on distribution systems for better service continuity. This relay coordinates better with fuses because of its extremely inverse time-current characteristics.

In a nutshell, this means that the relay will not trip open the breakers on overloads, but *will* operate quickly when currents of fault magnitude exist. The relay operating time decreases as the magnitude of the fault increases. Fuses have these same characteristics, and when used with the CO-10 relay, the degree of coordination that can be achieved makes possible a high level of service continuity.

Current settings are changed in the CO-10 relay by the well-known single-tapped coil system. Chief advantage of this system is that it keeps the flux density constant at corresponding multiples of minimum trip current for all tap settings. Thus the time-current curve is the same, regardless of the tap used.

Time-current curves are available for Westinghouse overcurrent relays with inverse, very inverse and extremely inverse characteristics. These curves are on transparent log paper so you can place the relay curve over your own fuse curve sheet and select the characteristic you desire. For curves or for additional information on the CO-10 relay, write to Westinghouse. J-40452

YOU CAN BE **SURE**...IF IT'S

"Rusty Campbell, Distribution Apparatus Product Engineer, discusses an important development . . ."

New sectionalizer has highest rating available today

We are now building GRS sectionalizers with a rating of 140 amperes which take their place beside other Westinghouse sectionalizers rated from 5 to 100 amperes. It is now possible to mechanically sectionalize important taps or portions of the main feeder where the continuous load current does not exceed 140 amperes.

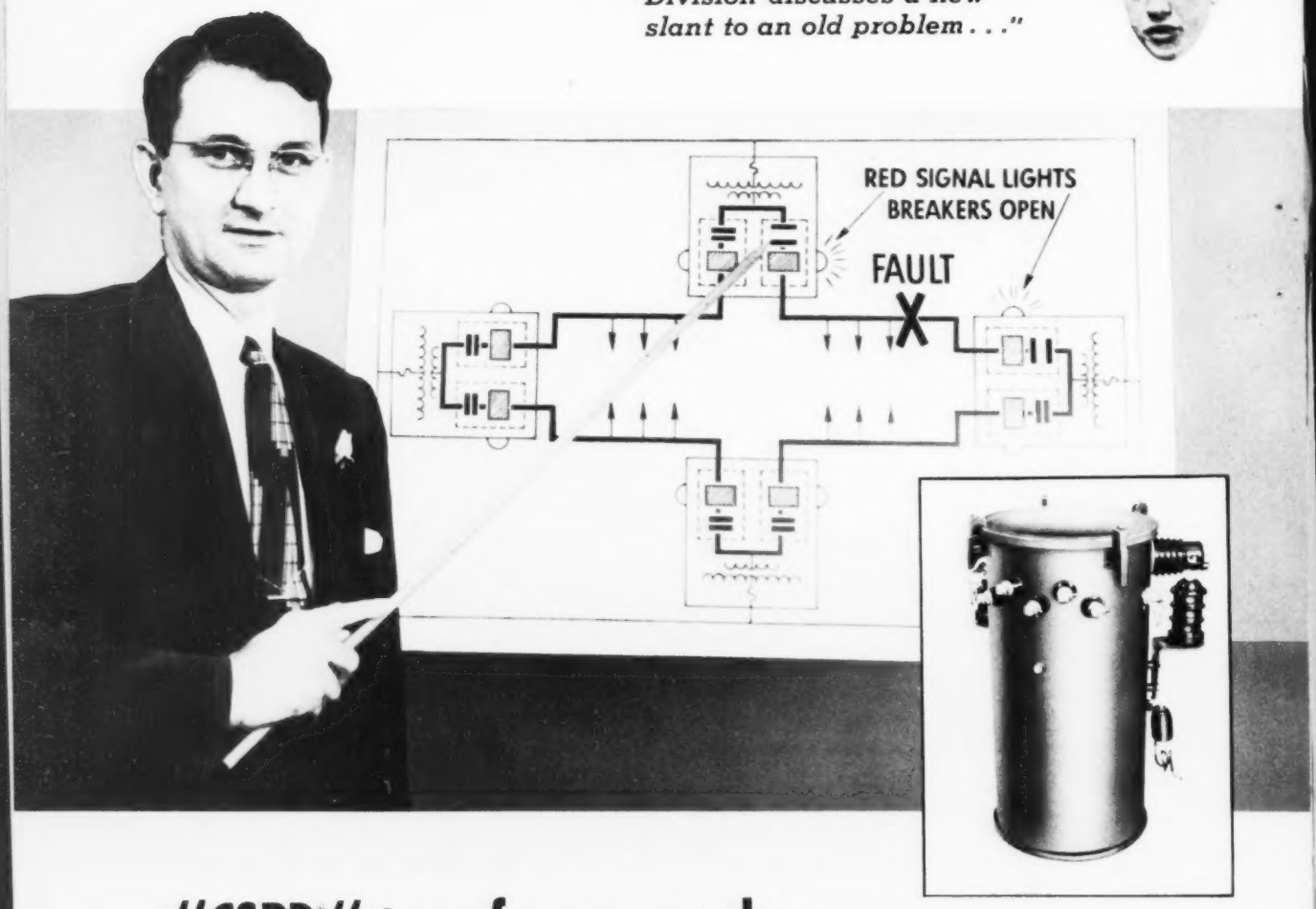
More and more utilities are applying these high-rated sectionalizers to solve service continuity and protection problems on their 2400 to 12,500-volt distribution lines. These sectionalizers are applied with reclosing station breakers and large reclosers and have these important advantages over fuses:

1. It is easy to coordinate sectionalizers and reclosing breakers because the sectionalizer has no time-current curve. (On temporary faults, it is practically impossible for the breaker to protect fuses on branches off the main feeder near the substation.)
2. Sectionalizers save money as there are no fuse links to replace. This also eliminates loss of coordination due to improper fuse replacement. Service is rapidly restored after a permanent fault by reclosing the sectionalizer with a hookstick or switchstick.
3. The sectionalizer has a load-break rating of 220 amperes and is, therefore, ideal for manually disconnecting or sectionalizing lines.

Westinghouse sectionalizers have the highest momentary rating available: 6500 asymmetrical amperes. The insulation is full 15 kv. Construction is rugged. The fault counter is magnetically compensated to eliminate temperature effect. Write for D.B. 38-760 for more information on this equipment. J-60844

Westinghouse

"Bob Ray of the Transformer Division discusses a new slant to an old problem . . ."*



"CSPB®" transformers make secondary banking practical for small towns, too

The inherent design of "CSPB" transformers gives small towns of eight to ten thousand population all the advantages of banked secondaries—without the disadvantages of fuse coordination—cascading blackouts and extensive system maintenance.

In a "CSPB" banked secondary system, a fault occurring anywhere on the secondary of the system is isolated. This is possible because each transformer contains two internal circuit breakers connected to the low-voltage circuit, one to serve each direction in which the secondaries extend. Red signal lights warn of overloads or indicate faulted sections. The breakers automatically isolate the area when a section is faulted or dangerously overloaded.

The entire transformer capacity is thus available to supply the remaining load. Due to diversity, less transformer capacity is needed—no problem of fuse coordination or cascading exists.

Internal protective links protect the system against line "lockout" by isolating a damaged transformer from the system. Complete lightning protection to high and low-voltage transformer windings is furnished by De-ion® arresters and coordinated low-voltage bushings, arranged for 3-point surge protection.

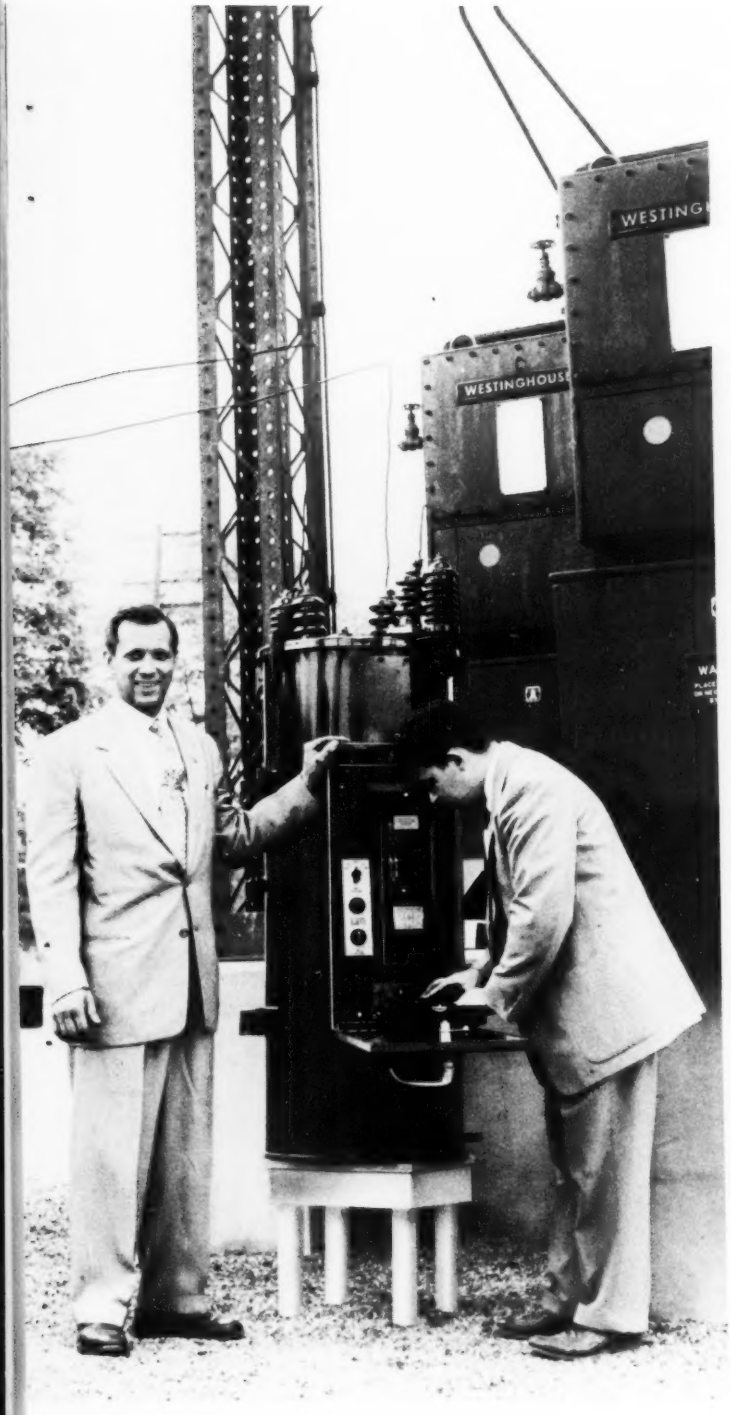
In addition, substantial savings are realized with an "engineered package" installation instead of the three or four hookups common to conventional installations. For more data, call your Westinghouse representative, or write for Booklet B-4310-A.

J-70702

*Manager, Distribution Transformer Sales

YOU CAN BE **SURE**...IF IT'S

"Here's Paul Sprowl, Manager of Step Regulator Engineering, to discuss a current regulator problem."



Field tests prove 16-step regulator gives optimum cost and continuity balance

Westinghouse engineers are well aware of your definite need in maintaining an optimum balance between the cost and continuity factors of feeder voltage regulation.

They knew from the start that 16-step design for pole-type regulators would provide the best regulation with minimum maintenance on a theoretical basis. Actual field test data, however, was needed before the theory could be verified and executed.

Three utilities cooperated and the Westinghouse URL-16 step regulator was tested against competitive designs. The results establish beyond any doubt, that the 16-step regulator fulfills industry requirements—with fewer operations—with better mechanical construction and electrical clearances and with excellent contact life and minimum maintenance.

Your Westinghouse representative now has a full report on these tests. He will be glad to show you actual figures proving the URL-16, pole-mounted regulator to be the optimum balance between your service continuity and cost requirements for feeder voltage regulation. Call him in for a practical discussion of economical service continuity. Or write now for Booklet B-5841, which describes many important features of the URL-16. J-10407

Westinghouse

"Al Larson describes a major cutout development which can help you maintain service continuity and obtain . . ."*

Real savings with the most flexible enclosed cutout

Why change the entire cutout when fault or load current increases, exceeding the rating of your present standard cutout? With the new, more flexible Westinghouse design all you do to meet these requirements is use one of the interchangeable doors.

This is the standard Westinghouse Prestite* porcelain, enclosed fuse cutout box. It is used for all three of the commonly used cutouts shown. Its sturdy construction and generous contacts make possible the exclusive door interchangeability feature.

Just think what this flexibility means to you—*one* housing, *three* cutouts.

FIRST: You can buy the standard EA, 50-ampere cutout, where fault and load currents permit. This means the lowest investment to start with.

NEXT: If *fault* currents increase beyond the 1200-ampere rating of the EA, an HC (high capacity) door can be added to the already installed box. The HC has an interrupting capacity of 5000 amperes at 5.2 kv and 8000 amperes at 2.5 kv.

THEN: Should *load* currents exceed 50 amperes, you can install the MC door in the *same box* which gives you a 100-ampere cutout having the same interrupting capacity as the HC (above).

No other cutout manufactured today provides this degree of flexibility. To change cutout ratings from standard to higher load current and interrupting capacity, you change only the door: from EA-50 to HC-50 or MC-100. All doors are available in dropout or non-dropout styles. The same flexibility is available at 7.8 kv.

Write now for more detailed information on the most economical cutout line available.

J-60845

*A. W. Larson is Manager, Switchgear Distribution Apparatus Department

YOU CAN BE **SURE**...IF IT'S

"Distribution Apparatus Product Engineer, Bob Lawrence, discusses a simple way to cut down service outages . . ."

Exclusive dropout feature prevents line lockout

Damaged arresters are rare. But a lot of trouble can be caused if an arrester locks out a line as a result of a nearby heavy, direct stroke or abnormal 60-cycle voltage through misapplication. Westinghouse LV arresters contain an exclusive dropout feature which prevents line lockout. A reduced section of porcelain at the bottom cracks, allowing the ground lead to drop out if the arrester is ever damaged. The broken ground connection is easy to spot, identifying the damaged arrester.

Westinghouse Autovalve® arresters are the only *distribution* arresters which are designed, tested and work on the same principles as large station and line-type arresters.

Each completed Autovalve element must pass two severe electrical tests:

1. Two hot lightning surge tests. A long-tailed (12 x 45 microsecond), 5000-ampere surge is applied while 60-cycle voltage is present (3000 volts).
2. Impulse characteristic test. A cathode ray tube records the volt-ampere characteristic when passing a 10 x 20 1500-ampere current surge. Blocks whose characteristics do not fall within narrow limits are rejected.

A durability test is applied to each batch of Autovalve blocks. A 5% sample receives 30 surges at 5000 amperes. Each completed LV arrester must also pass a pressure test and a 60-cycle sparkover test.

These exclusive tests and the dropout feature found only in Westinghouse distribution arresters have provided a spotless, 13-year field record.

Write today for D.B. 38-140 for detailed information on Westinghouse LV arresters. J-60843

Westinghouse

We're building the world's newest meter plant at Raleigh

Good service continuity makes more customers. To help you measure your growing loads, Westinghouse is now building this new meter plant at Raleigh, N. C. The smaller picture shows how it will look when complete next year.

We're really proud of this new plant. Its one-half-million square feet of manufacturing space will contain modern machinery and the latest in production and control techniques—devoted wholly to meter manufacture and development to meet your ever-expanding needs.

The new Raleigh plant will occupy 100 acres, conveniently located one mile north of Raleigh on U. S. Route 1. Two major railroads and three major airlines serve Raleigh and will help insure our aim of fast service to you.

If you're in the neighborhood of Raleigh next year, we hope that you will visit our "New Home of Metering".

* * * * *

For more information on the products described on these eight pages write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

CP-11(1011)

YOU CAN BE **SURE**... IF IT'S

Westinghouse

Socket

(*Continued from page* 122)

In testing 5-prong meters, it is necessary to replace the fifth or removable blade and put on a testing blade to contact one of the small center vertical clips.

Fiberglass Sleeve Protects Al. Strand

A fiberglass sleeve installed over the steel-reinforced aluminum strand of triplex service cable protects the soft strand from wear on the supporting bracket. Detroit Edison Co found the 4- to 6-in. sleeves to be both tough and low cost.

Rocket Gun Aids Conductor Stringing

Shooting a light rope with Coastguard rocket-gun equipment facilitated stringing conductors for a 132-kv line across Aber Gorge, near Bangor in North Wales.

Three towers were erected for the gorge section of the line. One was located at the top on each side of the gorge and the third on a spur in the valley. Conductor reels were set near the middle tower in the valley. A winch was located at the east tower.

The rocket with rope attached was fired 1,425 ft from the middle tower towards the east tower. Rope was then attached to the winch and the conductor was pulled in on the 1,800 ft span.

Procedure for pulling in the second span was partially reversed. Conductor reels were located near the west tower and the rocket was shot from this position 1,800-ft toward the middle tower. The winch, still in its original position at the east tower, was utilized to pull in conductors.

News about

B. F. Goodrich Chemical *raw materials*

Carolina Industrial Plastics Corp., Mount Airy, North Carolina, is one of the suppliers of Geon vinyl insulated wire for Fieldcrest Mills. B. F. Goodrich Chemical Co. supplies only the Geon raw material.

Helps build summer all year into blankets

THAT'S what these girls are doing as they insert 200 ft. of Geon insulated wire into each blanket to keep somebody warm and cozy all winter.

The makers of these blankets, Fieldcrest Mills, recently celebrated the manufacture of its one millionth electric blanket. Fieldcrest sells either woven shells or wired blankets to all major textile and electrical companies in the electric blanket field. A good deal of the mill's success is due to the use of wire covered with Geon vinyl insulation.

The choice of Geon vinyl resin, the same type of plastic used for raincoats, upholstery, garden hose, is due to the need for high dielectric strength and age resistance. In addition, Geon vinyls possess light weight, toughness and excellent moisture resistance.

Geon vinyl materials help you solve many problems. Products made from them can be either rigid or of flexible, transparent or colored. Let us help you select a Geon material suited to your needs to help you improve or develop more saleable products. For information and technical advice, please write Dept. GJ-11, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

Lighting–Air Conditioning Design Coordinated

Luminous ceiling provides 110 ft-c with cool clean air entering through sound-deadening baffles suspended at spaces between luminous ceiling sections

E. RODGER DODSON, Commercial Engineer, Electric Power Board of Chattanooga, Chattanooga, Tenn.

Lighting and air conditioning of the latest design were installed recently in the Sales Department offices of the Electric Power Board of Chattanooga. The offices were even redesigned somewhat to fit the new lighting system which provides the 2,750 square feet of floor area with 110 footcandles from a luminous ceiling type installation. Cost approximated $3.60 per square foot, which included the lighting fixtures, lamps, luminous ceiling, and labor.

Single and two-tube 40 watt fluorescent strips were suspended with heavy wire from the true ceiling on 16 inch centers, 12 inches above the luminous ceiling in most locations. The luminous ceiling was also suspended from the true ceiling with heavy wire. The plenum above the luminous ceiling was painted a flat white color for maximum efficiency.

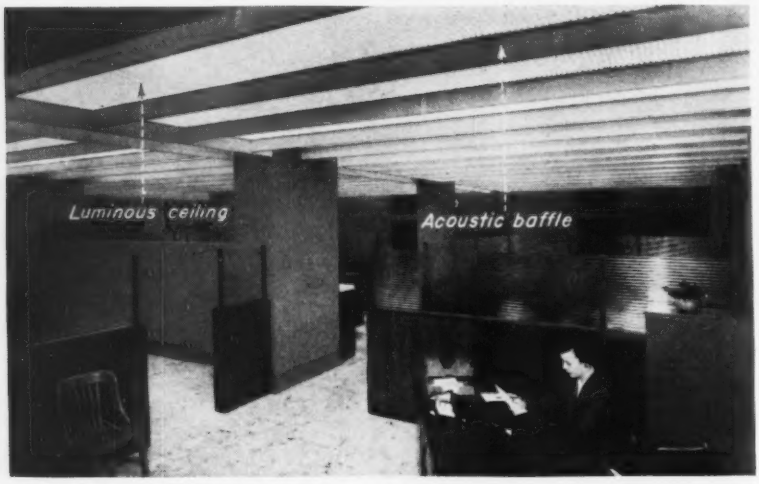
Acoustic baffles were attached to the under side of the luminous ceiling at 3-foot intervals to serve as louvers to break up the skylight effect of the ceiling and to lower the noise level throughout the offices.

The overall lighting efficiency of the installation was increased somewhat with the installation of light grey top desks and a mottled cream color tile floor.

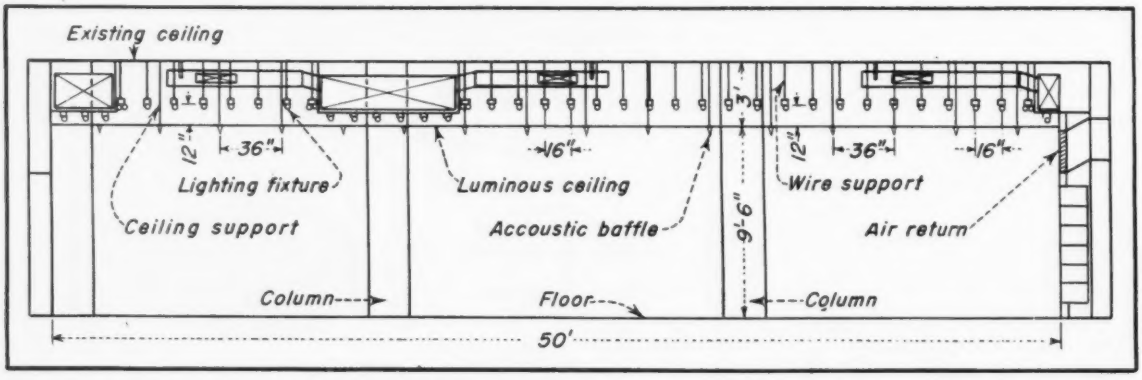
Cool conditioned air enters the plenum chamber above the luminous ceiling through nine 8 in. by 24 in. duct extensions. The ducts, each having two 6 in. by 24 in. openings, were equally spaced over the entire area to secure equal cooling effects for all personnel in the various offices. Ducts were suspended below the true ceiling and placed above the lighting fixtures to prevent interference with the lighting system.

The conditioned air enters the office proper from the plenum above the luminous ceiling through the spaces between the edges of the plastic ceiling and the hanging steel supports at 3-foot intervals across the ceiling area.

Return air grills and ducts were installed at three locations on the north wall of the offices.



LUMINOUS ceiling gives attractive 110-ft-c lighting job and cool clean air enters area around acoustic baffles. Luminous plastic sections are easily rolled up and removed for washing



Plastic luminous ceiling is suspended three feet below true ceiling with single and two-tube, 40-w, fluorescent strips suspended on 16-inch centers 12 inches above luminous ceiling. Acoustic baffles are attached to under side of ceiling and air enters area around them

Burying Cable on TOP of the Ground

Recently an electric railway company decided on a line extension. Before they could lay the track they had to raise the grade of an existing roadway. Fortunately someone thought of burying the underground signal cable the easy way.

The electric railway scooped out a shallow depression, lined it with sand, put in the Simplex-ANHYDREX Signal Cables, covered them with sand, and then they filled the roadway to a depth of about four feet with fill. The top of the concrete pedestal will be at grade.

The electric railway showed good judgment on two counts. First, they buried the cable in the least expensive way and, second, they used Simplex-ANHYDREX Signal Cable which will give them dependable service for a long time to come.

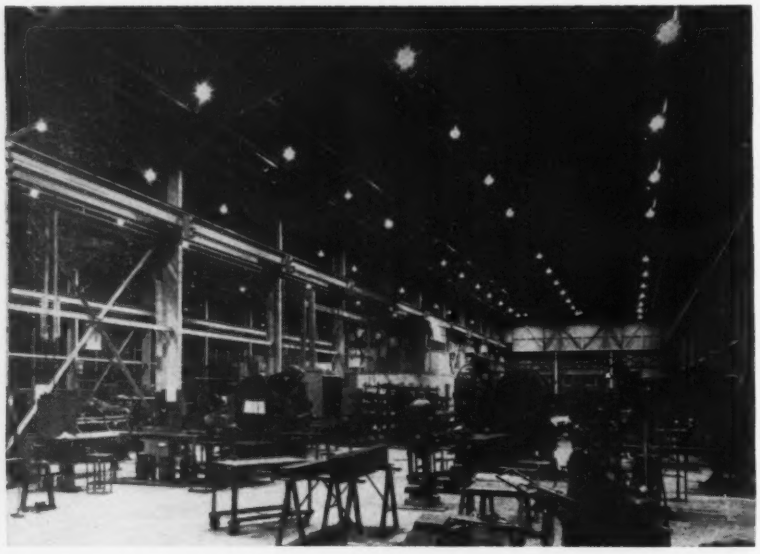
Why did the railway buy ANHYDREX Signal Cables? Because the Anhydrex insulation will retain its electrical and physical properties indefinitely. This insures long life and dependable operation. The cable is easy to install, splice and terminate. It has no metallic sheath to crack from vibration or deteriorate from electrolysis. It does have a special metallic tape to resist termites, etc.

These are a few of the reasons why railways, public utilities and industrial plants are using ANHYDREX Cables for signal, control and communication services.

Simplex
WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

All Lighting Is Overhead in St. Louis Machine Shop



ROGER W. RENKEL, Industrial Lighting Engineer, Union Electric Co of Missouri, St. Louis

Providing sufficient general lighting to eliminate the necessity of supplementary illumination on machines was the problem solved in an installation made recently by Union Electric Co of Missouri at a machine shop of the Moloney Electric Co in St. Louis.

For the job, 750-w, R-52 reflector lamps were used. Spaced 14 ft by 14 ft from a 25-ft mounting height, they produce an average intensity of 57 ft-c.

This intensity will remain practically constant, because after the 2,000-hour lamp life a new lamp with built-in reflector replaces the old one.

The installation was designed by the author.

Every Day Is a Blue One Now, Survey of Housewives Shows

From a 1953 survey of electric appliance use by 560 residential customers of the Boston Edison Co in 18 selected areas, it appears that Monday is no longer the regular washday among the sampled groups.

Customers with low, medium and high electric use and in low, medium and high income brackets were covered.

The study indicates that 77.5% of the group surveyed do their own washing in automatic or non-automatic machines. This work is done on an average of 2.56 times per week per family. The survey shows that now only 26.4% of the household washing is done on Monday, with 73.6% spread somewhat uniformly over the rest of the week.

This change in washday habits certainly contributes toward improvement in the residential customer's load factor.

In one survey area (not included in the tabulation) 49 completed interviews were secured in a housing project with 54 apartments.

Of the 49 apartments surveyed, 32 have 4 to 5 rooms; 15 have 5 to 6 rooms, and 2 have 6 or more rooms each. There were 113 adults and 72 children in residence. All apartments were occupied by middle income families.

Thirty-six of the 49 families interviewed do their own washing. Eighteen apartments have washers in the apartments (10 automatics and 8 non-automatics). Laundry facilities are provided in the basement for families not having their own machines. The basement laundry contains 3 automatic washers and 1 dryer which are rented at the rate of 15 cents for each run. This sharing of washing facilities of necessity requires scheduling of their use and this of course spreads the use of the facilities over the week somewhat more than where each family possesses a machine of its own.

In this group 26 was on Mondays, 11 do so on Tuesdays, 20 on Wednesdays, 12 on Thursdays, 14 on Fridays, 10 on Saturday, six on Sundays and five on no particular day.

Thus, the possession of a washing machine by any home occupier frees that family from washday limitations, whether in a detached housing unit or in an apartment.

From the utility standpoint it spreads the demand over many hours (usually in the forenoon) and over the seven days of the week.

What Boston Edison found out about washday

	Income Groups								
	High			Middle			Low		
Interviews	37			45			93		
Laundry Equipment Reported:									
Non-automatic Washers	17			9			46		
Automatic Washers	24			22			18		
Dryers	3			3			1		
Ironers	8			3			1		
When Washing Is Done:	**AM**	**PM**	**NPT***	**AM**	**PM**	**NPT***	**AM**	**PM**	**NPT***
Monday	12		2	22	1	2	34		10
Tuesday	3		2	2	1	2	5		
Wednesday	8		2	10	1	2	8		2
Thursday	3		2	5	1	2	5		
Friday	7		2	7	1	2	11		2
Saturday	3	1		3	1	2	7	1	6
Sunday	2	1		1	1		4		1
No Particular Day	1		6		1	6			8

*No Particular Time

Partial Assemblies Courtesy of Hermetic Seal Products Co.

Now 4 D-H Special Alloys Cover Most Glass-to-Metal Sealing Needs

From a single source, the Driver-Harris Company, you can now obtain metal alloys to meet your glass-to-metal sealing needs for both *hard* and *soft* glass.

NEW ALLOY THERLO* This cobalt, nickel iron alloy, possesses ideal properties for sealing hard or thermal shock resistant glass. It matches such commercial hard glasses as Corning 7052 and 7040 in expansivity from 80°C to the annealing point. It produces a permanent vacuum-tight seal with simple oxidation procedure and resists attack by mercury. Readily machined and fabricated, it can be welded, soldered or brazed.

DRIVER-HARRIS 142 ALLOY contains 42% nickel. This is the standard alloy for sealing into sealed beam auto lamps using Corning 776 glass. Used with a borated copper coating, it is the accepted seal for incandescent lamps and radio tubes and matches 8160 glass.

DRIVER-HARRIS 52 ALLOY contains 50% nickel. It provides a slightly higher coefficient of expansion than the D-H 142 alloy and seals successfully with 0120 glass.

DRIVER-HARRIS 146 ALLOY contains 46% nickel. It offers special expansion properties, which permit seals with ceramic coated materials as shown above.

Manufactured to the same high standards that have made Driver-Harris the leader in special purpose alloys for more than 40 years, these alloys are available as rod, wire, strip, sheet foil — and in special shapes. They enable you to meet your specific sealing needs from a single source — so why not consult us today.

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MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

SPEAKERS AND CHAIRMAN discussing industrial and commercial lighting (l to r) are S. B. Williams, Sylvania, Chairman, NEMA National Lighting Bureau; Henry Fagin, Regional Plan Association, and E. B. Haskell, United Illuminating Co, and Power Club Chairman

LIGHTING PANEL SPEAKERS (l to r) H. J. Peters, Con Edison; S. F. MacLean, United Illuminating Co; R. H. Walker, Pennsylvania Power & Light Co; G. W. Wagner, Philadelphia Electric Co; and panel moderator S. A. Moore, Public Service Electric & Gas Co of N. J.

Industrial Lighting Featured at Power Club

Utility engineers should be extremely interested in the thousands of small industrial and commercial relighting jobs according to S. B. Williams, Sylvania Electric Products, Inc, and Chairman of the NEMA National Lighting Bureau. Williams addressed more than 100 utility power sales engineers at the Interstate Power Club meeting held in New York, October 5. He said that the long burning hours make this relighting load more profitable to the utility than almost any other load. Furthermore, the lighting in 90% of the small industrial plants is below the minimum ASA Standard—and in a large percentage of cases it is below World War I standards.

Market Development Program . . . Williams urged utility power engineers to marshall the forces within the industry that are the point-of-sale contacts into a coordinated market development program and suggested mass selling through training and directing the mass sales contacts. He described to the group the new NEMA National Lighting Bureau which is being set up this fall to launch a national campaign to relight commercial and industrial interiors. Local lighting bureaus will be set up to help launch successfully local relighting promotions, he said.

S. A. Moore, Public Service Electric & Gas Co, acting as moderator of a panel discussion on "How We Sell Industrial Lighting," summarized 10 important points in selling industrial lighting as follows:
(1) Thoroughness in preparation of the proposal, (2) Patience with persistence, (3) Knowing the customer's plant, (4) Well engineered — IES Standards or better, (5) Develop proof that good lighting will pay off, (6) Get to the right people, (7) Develop close friendly contacts, (8) Try to find a specific sales argument, (9) Know what the market offers and suggest what to use, and (10) Be able to demonstrate the benefits of quality and quantity illumination.

Get To Top Officials . . . In describing the procedure used by Philadelphia Electric Co in selling the relighting of the Baldwin Locomotive Works, G. W. Wagner, Phila. Elect., said that copies of the complete survey and report made by Philadelphia Electric were given to 12 top officials of Baldwin. As a result of this survey and report, over 4000 kw of additional lighting was installed in 1951 and 800 kw in 1952, he said. The relighting of Baldwin's Diesel Welding Shop (increased from 4 ft-c to 30 ft-c by installation of 3-kw mercury tube units) reduced manhours required to turn out 50 diesel engine blocks a month by 10.8%, he said.

Local weather bureau records on the percentages of clear and cloudy days completely convinced an Allentown bathing suit manufacturer that natural daylight was undependable, said R. H. Walker, Pennsylvania Power & Light Co. This was responsible for changing modernization plans and substituting good artificial lighting for a new glass brick wall, he said. Another effective selling tool used was the showing of samples of bright cloth taken from a show window after exposure to sunlight.

A-C Fluorescent Lighting . . . H. J. Peters, Con Edison, described the effectiveness of a survey and complete layout and proposal made by Con Edison for relighting a plant formerly having 240-v fluorescent lighting connected on their own d-c generation. By pointing out the benefits and advantages of a-c fluorescent lighting, the utility's a-c service to the plant was enlarged to accommodate 59 kw of new lighting which will be expanded to 167 kw next year.

According to S. F. MacLean, United Illuminating Co, if production is increased by 17 seconds, a profit can be shown on the installation, operation and maintenance of a good industrial lighting system. He demonstrated figures obtained from the Uxbridge Worsted Co where a new lighting system increased illumination from 16 to 52 ft-c. The load growth for this installation was from .8 to 3-4 w per sq ft, he said.

Reliable *Accurate* *Low Cost*

R-F CABLE MEASUREMENTS

in accordance with **JAN Specifications**

Complete Setup for attenuation measurements at the JAN specified frequency of 400 Mc. Equipment includes the G-R Type 1208-A Unit Oscillator, the 1231-B Amplifier and Null Detector and various coaxial components. With appropriate high-frequency oscillators, measurements may be made at any frequency from 200 Mc to 4000 Mc.

Key Element is the Type 874-GA Adjustable Attenuator operating on the wave-guide-below-cutoff principle. It is an accurate, continuously adjustable *primary* standard whose ultimate accuracy depends only on mechanical dimensions; specifically, the inside diameter of the attenuator tube and the accuracy of two screw threads. Price $55

For Designers, Manufacturers and Users of r-f cables . . .

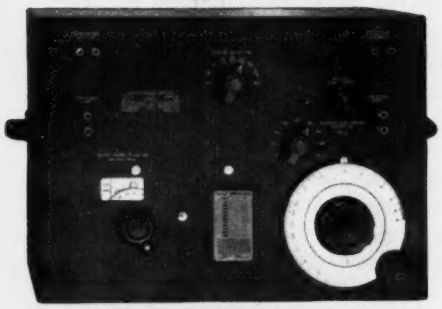
offers a well integrated group of instruments and components for highly accurate measurements of . . . *Attenuation . . . Characteristic Impedance . . . Velocity of Propagation . . Capacitance . . . Insulation Resistance.*

Manufacturers of coaxial and dual-coaxial cables, t-v twin-lead and shielded twin-lead are now using G-R equipment with highly satisfactory results. In the insertion-loss method illustrated above, attenuation measurements are made with an accuracy of better than $1\% + 0.2$ db. Accuracy is independent of crystal-detector calibration. Well-designed G-R Type 874 coaxial connectors eliminate troubles from leakage and bad contacts. The equipment is readily assembled and easy to operate.

Insulation Resistance is measured directly by the Type 1862-A Megohmeter at the commonly accepted ASTM potential of 500 volts.

The instrument range is 0.5 to 2,000,000 megohms — accuracy is 3% to 50,000 megohms, decreasing at higher resistances. Guard and ground terminals are provided for measurements of three-terminal samples. A panel switch removes voltage from the unknown terminals permitting connections without danger of shock.

Type 1862-A Megohmeter $225



Cable Capacitance and Capacitance Unbalance are measurable to a high degree of accuracy with the Type 716-C Capacitance Bridge — an instrument used the world over for capacitance standardization.

In substitution measurements, accuracies obtainable are $\pm 0.1\%$ or ± 0.5 $\mu\mu$f, whichever is greater, for values up to 1000 $\mu\mu$f — frequency range is 30 cycles to 300 kc. With appropriate techniques, this bridge will also measure inductance and resistance as well as capacitance and conductance.

Type 716-C Capacitance Bridge (mounted in walnut cabinet) . . $545

Velocity of propagation is measured, to an accuracy of within $\pm 0.5\%$, with the same equipment in another configuration. Characteristic impedance is readily calculated from the values for velocity of propagation and capacitance per foot of cable.

Please send a copy of the NEW 14-page bulletin "MEASUREMENT OF CABLE CHARACTERISTICS."

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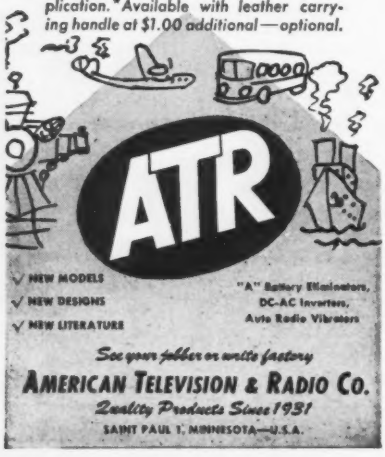
AT NEW LOW COST $25.55 And Up Retail Price

For Inverting D.C. to A.C. . . . Specially Designed for operating A.C. Radios, Tape Recorders, Wire Recorders, Record Changers, Television Sets, Amplifiers, Address Systems, Radio Test Equipment and most small electrical and electronic devices from D. C. Voltages in Vehicles, Ships, Trains, Planes and in D. C. Districts.

Type	Input DC Volts	A.C. Output 60 Cycles	Output Wattage Int.	Output Wattage Cont.	Consumer Net Price
6-LIF	6	110 volts	40	35	$25.55
12-LIF	12	110	50	35	25.55
*6-RSD	6	110	85	75	39.25
*12-RSD	12	110	125	100	39.25
32-RSD	32	110	150	100	39.25
110-RSD	110	110	250	150	39.25
*12T-HSG	12	110	250	200	96.45
110AT-RHE	110	110	325	250	56.95

*There is an ATR model for most any application. *Available with leather carrying handle at $1.00 additional—optional.*



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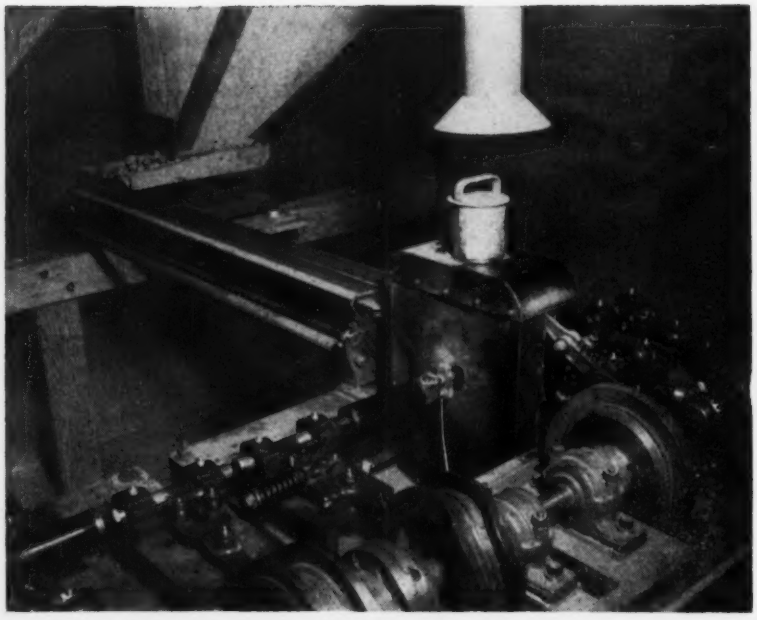


ELECTRIC NUT CRACKER consists of two electrodes enclosed in metal box. Walnuts feed singly from hopper at left by screw conveyor. Funneled pipe removes dust and ozone to lessen danger of explosion

Cracker Shells Walnuts with 65,000 V

Cracking of walnuts electrically at 65,000 v has speeded up, improved efficiency and cut cost of the shelling operation for Northwest Nut Growers, Portland, Ore. Using a nut cracking machine of their own patented design, the Portland association claims the new process, operating at one-third of capacity, shells nuts at 1,200 lb of in-shell nuts per hour, compared to the former crusher process which handled nuts at 800 to 900 lb per hour. Electric cracker produces nuts of higher quality, with less damage due to chafing and breakage, and requires a crew of 60 workers, 40 less than were needed to operate the crusher.

Unique feature of the nut cracker are two movable electrodes that grasp each nut in mid-air as it falls from a screw conveyor. At that instant the electrodes discharge and 50-microsec direct current of about 5,000 amp at 65,000 v shatters the shell. Because the current passes through the shell, both meat halves are largely undamaged as to original shape and are not affected otherwise by the process.

Nut cracker consists of a 50-kva transformer that feeds six kenotron rectifiers connected three-phase, full wave. Rectifiers supply energy to a storage capacitor, consisting of 25-kv units, through a smoothing iron-core reactor. Storage capacitor serves to maintain the charge on a discharge capacitor that is electrically across the cracking electrodes. To limit the current between capacitors, an iron-core reactor is placed between them in series, with a resistor added to prevent oscillations in the capacitor loop.

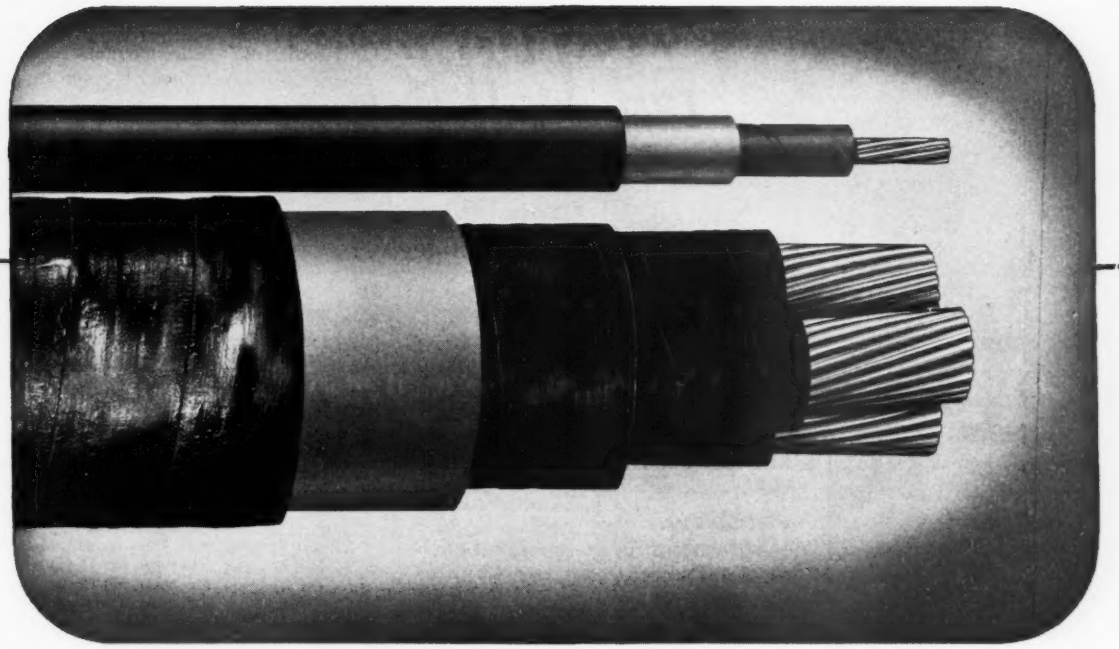
To trigger and extinguish the current surge, an interrupter and a distributor are in series with the electrodes. Interrupter consists of two contact rods, one at each end of an insulated rotating arm. As each rod passes between two stationary contact points, discharge circuit is completed and current is fed to the distributor which is geared to the interrupter shaft.

Distributor consists of two insulated rotating arms each with a contact rod at each end. These rods both rotate past nine contact points mounted on insulators that project inwardly from stationary circular mounts. Insulated contact points lead to cracking electrodes and thence to ground. One distributor serves 18 cracking machines.

Nut cracker is supplied from 60-hp motor-generator set operating at 440 v, 3-phase. M-g set acts to isolate any fluctuations in load from the lines.

ROEBLING PROTECTIVE COVERINGS ON LEAD SHEATHED CABLE

for utilities, chemical plants and the petroleum industry



LEAD SHEATHED CABLES used in certain applications by public and private utilities, chemical plants and the petroleum industry are often impaired by electrolysis or chemical corrosion. But such corrosive action can be effectively reduced, and cable life extended, by using Roebling Paper Insulated and Varnished Cambric Cables with either of two outer protective coverings.

One of these coverings is an extruded thermoplastic sheath employing a special high-molecular weight polyethylene. The other is ROESHEATH, built up of neoprene and neoprene-filled fabric tapes and vulcanized directly over the lead sheath. Both coverings not only provide essential protection, but, in some cases, may permit the thickness of the lead sheath to be reduced.

For longer, more dependable cable life and worthwhile economy write for full information... and get our recommendations for solving any special problem.

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ATLANTA, 934 AVON AVE • BOSTON, 51 SLEEPER ST & 5 PITTSBURGH ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREDONIA AVE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST • DETROIT, 915 FISHER BLDG • HOUSTON, 6216 NAVIGATION BLVD • LOS ANGELES, 5340 E. HARBOR ST & 120 S. HEWITT ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1920 E. 2ND ST • PHILADELPHIA, 230 VINE ST • PITTSBURGH, 1202 GRANT BLDG • ROCHESTER, 1 FLINT ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 321 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, NEW JERSEY

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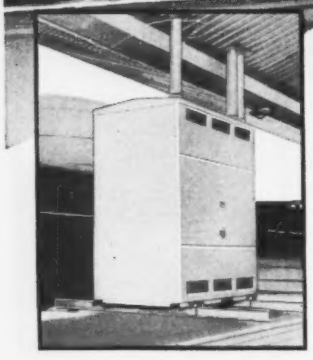

SANTA FE RAILWAY · UNION PACIFIC RAILROAD · SOUTHERN PACIFIC COMPANY

Specifications for the stringent power requirements for Los Angeles Union Passenger Terminal were set up by a group of electrical engineers representing the three railroads that operate the terminal, and were met by the purchase of Marcus dry type Transformers.

The installation consisted of 12 Marcus 300 KVA, 3 Marcus 225 KVA dry type Transformers installed outdoors. All Marcus dry type Transformers are now being constructed with Hi-Heat, Hi-Dielectric Magnet Wire, insulated with DuPont's Newest miracle polyester film "Mylar," combined with Johns-Manville "Quinterra" to reach insulation levels at least 10 times present industry standards.

Increase your power performance standards with Marcus dry type Transformers.

Capacities from 1 to 3000 KVA

- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

MTC

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Representatives in Principal Cities

MARCUS TRANSFORMER CO., INC.
HILLSIDE 5, NEW JERSEY

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DRY TYPE TRANSFORMERS EXCLUSIVELY

INDUSTRIAL BRIEFS

Joining plastics with two dielectric heaters at the Williamsport Die and Machine Co, Williamsport, Pa. quadrupled production, saved labor (two men), increased profits and resulted in a superior product. Heaters are used for joining edges of plastic hunting license holders and other similar joining operations. Demand is 10 kw. Kenneth Breon, Industrial Representative, Susquehanna Division, Pennsylvania Power & Light Co.

Heating clay hopper with 5½ kw of flat strip heaters bolted to the outside steel walls prevents small particles of flying clay from sticking to inside of hopper and eliminates need for manual cleaning at Ava Brick Company, Ava, Ohio. Formerly, clay would build up and clog mechanism of unit unless cleaned manually at cost of about $10 per day. J. G. Flint, Industrial Power Eng, Ohio Power Co.

SEND IN *YOUR* INDUSTRIAL BRIEF

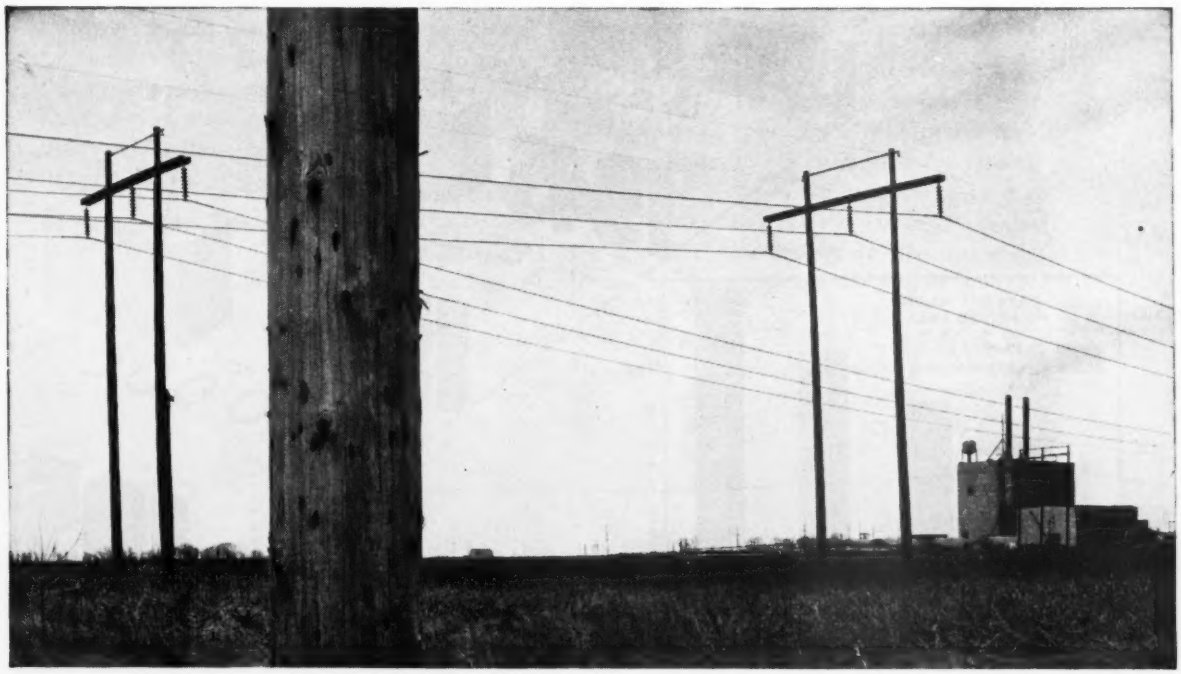
You'll get more satisfaction from knowing your item helped someone else than from the $5 you will be paid for each item accepted. Give us the basic facts covering the application; the name and location of user; benefits, advantages, and load characteristics of the application. Mail to: Industrial Briefs Editor, Electrical World, 330 W. 42 St., New York 18.

Bonding Scotchlite letters on large metal outdoor signs has been speeded up at National Advertising Co, Midvale, Utah, by use of infra-red lamps. Production has been increased 100% and a far superior job results. Previously an activating compound was applied by hand brushing to back of each letter. After letters were applied to metal background, they could not be removed or adjusted once touched to the metal. Now dry-back letters are merely laid out on metal sign and adjusted to perfect spacings and alignment. Sign is moved under bank of 40 250-w infrared lamps and baked for 10 min. It is then moved between two large motor-driven rubber rollers to effect perfect seal. Additional 14 lamps are added to accommodate signs up to 4 x 10 ft.—Wayne F. Mulcock, consultant, Business Development Dept, Utah Power & Light Co.

DOW

H-FRAMES BUILT TO LAST BY A LEADER IN POWER TRANSMISSION

Consumers Power protects new Erie transmission line with clean PENTA, the modern wood preservative



The Dow Chemical Company
Dept. PE 3-2B11, Midland, Michigan.

☐ Send me free booklet, "Pointers on Penta."
☐ Send me list of PENTA treating plants.
☐ I am interested in the application of PENTA to_____

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City_____ State_____

Congratulations to Consumers Power on the recent completion of the first two units of its new Justin R. Whiting power station and three important transmission lines at Erie, Michigan.

We are proud that PENTA*, the clean wood preservative, was elected to play a part in keeping this new network of power lines sound and serviceable for many years to come. This is a high compliment from a company well known for its progressive policies and dependable service.

From a standpoint of service and dependability these PENTA-treated H-frames will give a good account of themselves.

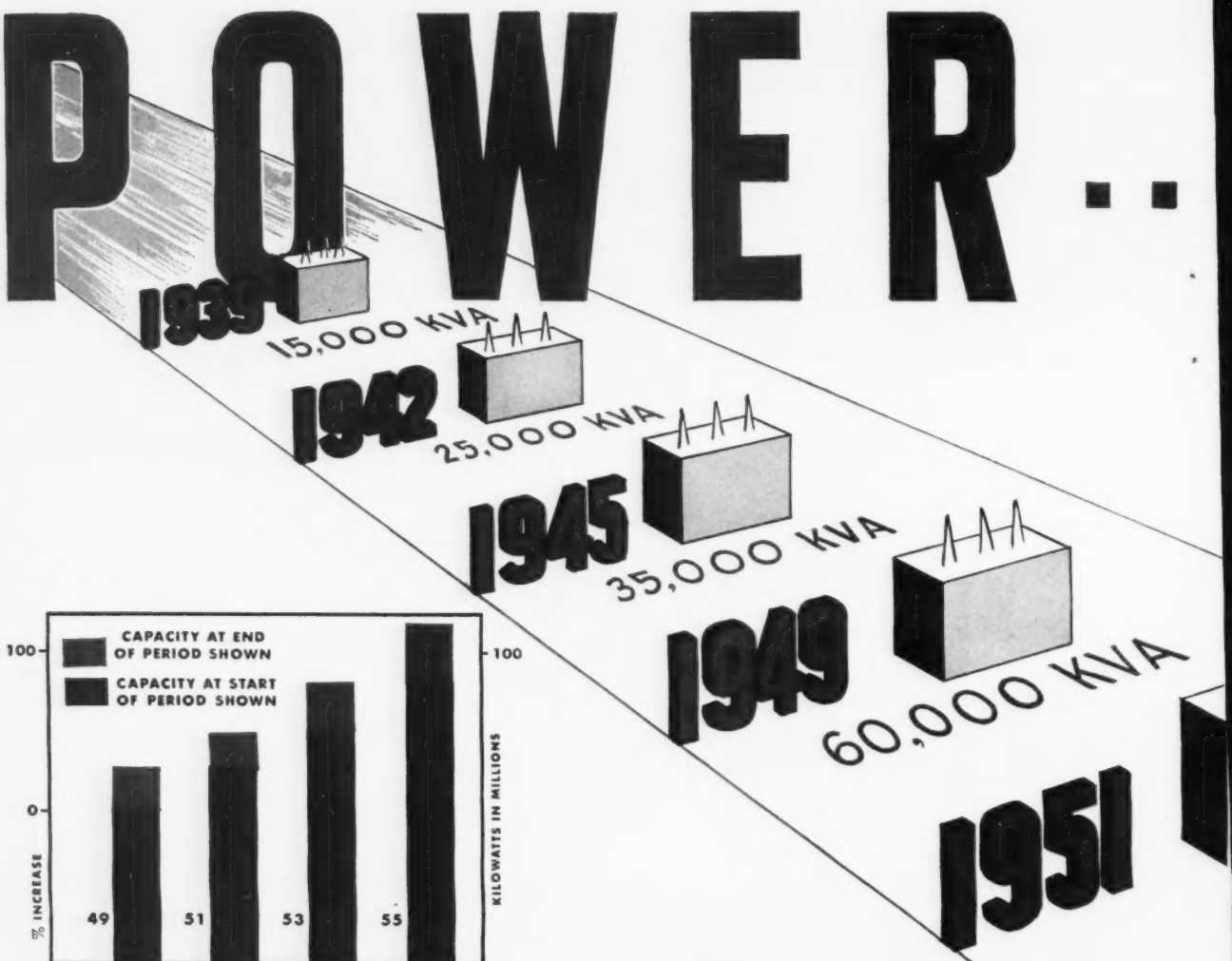
PENTA-treated poles and crossarms give positive protection against decay and termite attack.

Along with lasting protection, PENTA-treated poles are clean and attractive. They present a pleasing appearance along the countryside. Over 60 pole suppliers now treat with PENTA. Ask your regular supplier about *clean* *PENTAchlorophenol or write THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS

DOW

POWER . .



WHAT THE INDUSTRY NEEDS

Forecasts by American Utilities of Kilowatt capacity through 1955 are shown in diagram above. Shown also in blue are the utility needs which were accomplished each year since 1949 as well as the Kilowatt capacity that will be required through the year 1955.

Shown in outline above, new construction almost completed at the Moloney Plant, which includes a crane bay 70 ft. high, 80 ft. wide and 530 ft. long to be equipped with two 100 ton cranes and other equipment necessary for building transformers of any Kva and voltage rating.

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers

..PANORAMA

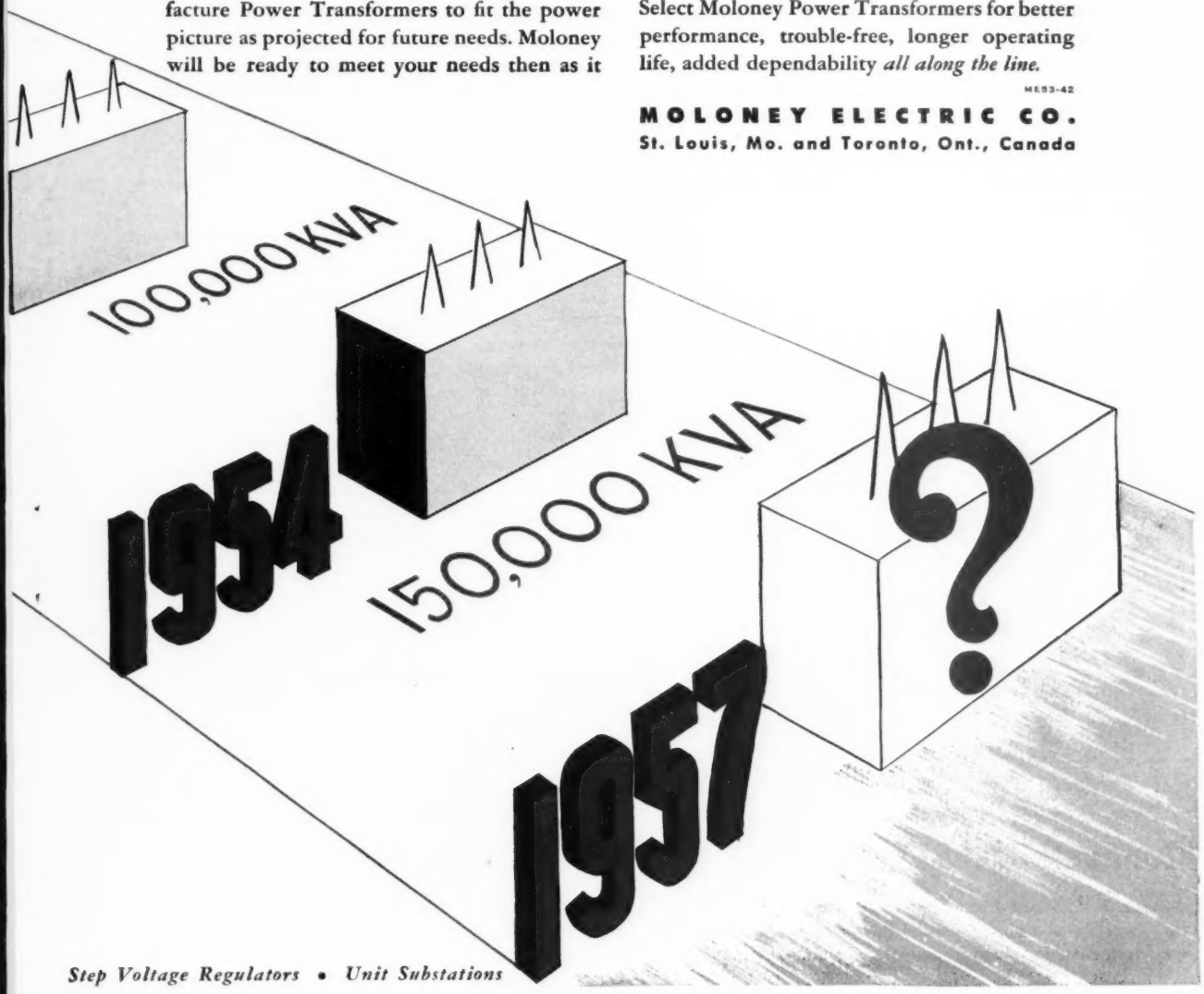
No one can accurately foretell the future, but Moloney is preparing for it in conjunction with the power perspective as predicted by the leading utilities. The trend of the last decade foretells that tomorrow's power transformers will dwarf today's. Utilities now are designing transmission and distribution facilities of even greater capacities to serve soaring demands economically and efficiently.

Moloney is now building facilities to manufacture Power Transformers to fit the power picture as projected for future needs. Moloney will be ready to meet your needs then as it has throughout the past 57 years. Yes Moloney is expanding again . . . constructing a giant, specialized plant with completely modern facilities to assemble and test Power Transformers of any Kva and voltage rating.

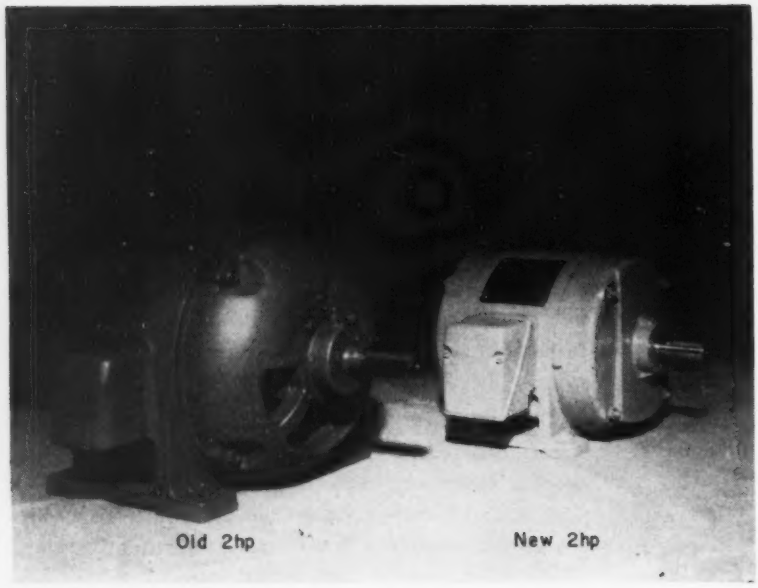
In designing your system, give it the high "margin of safety" inherent in Moloney Power Transformers . . . products of the superior engineering, design and fabrication that have been the mark of Moloney for over half a century. Select Moloney Power Transformers for better performance, trouble-free, longer operating life, added dependability *all along the line.*

ME53-42

MOLONEY ELECTRIC CO.
St. Louis, Mo. and Toronto, Ont., Canada



Step Voltage Regulators • Unit Substations



Polyphase Induction Motors

A new line of polyphase ac motors with good protection, high efficiency, and quiet operation has been announced. Tri-Clad "55" motors are built to standard NEMA frame dimensions and are said to be 50% smaller in volume and 22% lower in weight per horsepower than former models. Motors incorporate a new insulation system, ventilation plan, and bearing assembly.

Insulation system consists of a new polyester film used to insulate phases and slot tubes in the stator. Formex wire windings are impregnated with Glyptal varnish. The completed stator core assembly is then coated with water-repellant Dri-film silicone varnish.

A large double-end ventilation system with large integrally-cast rotor fans uniformly cools the motor. Air is drawn in from beneath both end-shields, passes through baffled passages, and goes out louvers in the frame sides.

Bearing assembly is tightly sealed and is lubricated by a long-life grease. Motor sound is said to be altered so that it is more pleasing to the human ear.

After the first of the year, motors will be available in 1, 1½, and 2-hp rating at 1,800 rpm, in horizontal drip-proof and totally-enclosed fan-cooled models, and as gearmotors.
General Electric Co, Schenectady 5, N. Y.

Connector

A new corrosion-resistant, parallel groove connector for transmission and distribution lines that is slipped over the conductors has been announced. It is claimed to accommodate copper, aluminum, or ACSR conductors in AWG sizes that range from No. 6 to 4/0.

Corrosion-resisting properties result from a silicon-aluminum alloy and a special surface treatment. After the assembly is chemically cleaned, it is immediately dried and dip-coated with an oxide-inhibiting seal. Coating on the contact surface is removed by pressures up to 20,000 psi during installation to provide a high conductivity joint.

The ⅜-in. hot-galvanized steel carriage bolt, lock washer, and hex nut hold the identical fitting halves together. End of the bolt is burred to prevent accidental removal of nut. The manufacturer recommends use of oxide-inhibiting compounds for all installations.
Thomas & Betts Co, Elizabeth, N. J.

Current Transformer

A new through-type current transformer, Type TWM, for indoor or outdoor service has been announced. It is molded in thermo-setting resin, which serves as insulation, support, and casing. This construction has an inherent toughness that promotes long life and is highly weather resistant, it is claimed.

The transformer's elliptically-shaped window is 1⅜ x 2¾ in. and accommodates two 500,000 cir mil stranded conductors with 600-v insulation. Transformers have conventional accuracy for light burden metering. With 200-amp primary it has ASA classification of 0.03 with the burden B-0.1, and 0.6 with burden B-0.2. The 400,600,

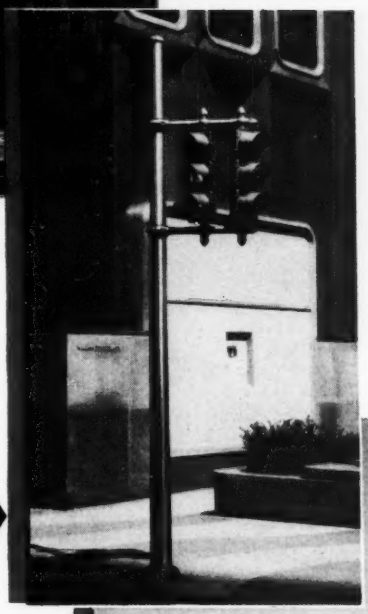
HAPCO Aluminum Alloy Standards

for Street Lights
Traffic Lights
Flood Lights

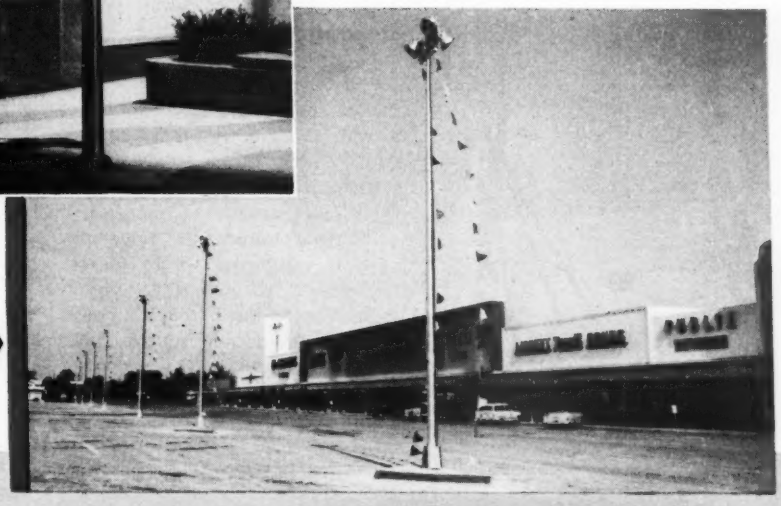
A New England city chooses this Hapco Standard and Bracket with special features including a festoon outlet used as a plug for a photo-electric cell.

The urge for civic beauty is dotting the map everywhere with attractive Hapco Aluminum Alloy Standards and Street Lighting Brackets.

Hapco Aluminum Alloy Standards retain their original lustrous beauty, untarnished by atmospheric conditions. Long life with a complete lack of maintenance requirements guarantees a minimum overall cost. Hapco gracefully tapered standards have equal wall thickness and uniform strength throughout. Their high visibility helps to reduce accidents. Their light weight — about one-third that of steel — makes them easy to handle, easy to erect. Available in seamless lengths up to 40 feet—adaptable to any type of internal or external circuits.



A Hapco Aluminum Alloy Standard with traffic lights harmonizes with the world's first building with all-aluminum exterior walls.



A parade of Hapco Standards with floodlights illuminates a new shopping center in the sub-tropical South.

HUBBARD ALUMINUM PRODUCTS COMPANY

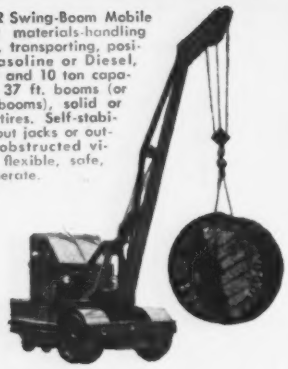
MANUFACTURERS OF HAPCO QUALITY ALUMINUM PRODUCTS

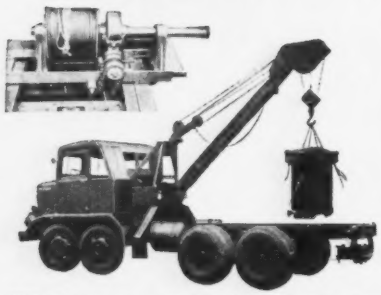
A Division of HUBBARD and COMPANY

6301 Butler Street • Pittsburgh 1, Pa.

Utilities Have Specified
SILENT HOIST Equipment
• Since 1918 •

KRANE KAR Swing-Boom Mobile Crane: for materials-handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 5 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.





WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING-BOOM CRANES: Truck: Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.

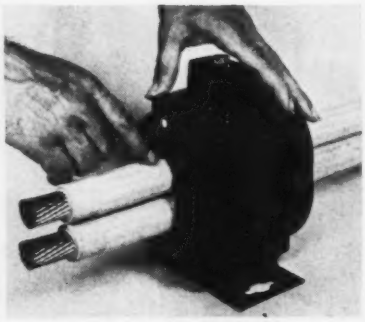
TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or racking platforms.

TRIPOD POLE DERRICKS: for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.

USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

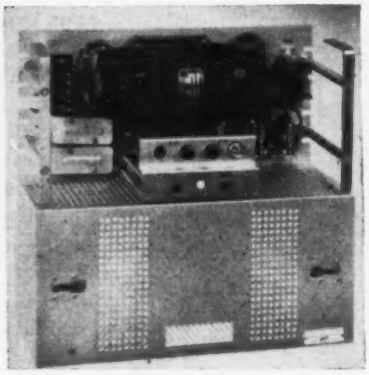
WRITE FOR CATALOGS:
No. 79—KRANE KAR *No. 70—Truck Equipment*

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
2½, 5, AND 10 TON CAPACITIES
KRANE KAR
TRADE MARK REGISTERED
SILENT HOIST & CRANE CO.
862 63rd ST., BROOKLYN 20, NEW YORK



and 800-amp primary has 0.3 accuracy at burdens either B-0.1 or B-0.2.

Allis-Chalmers Manufacturing Co, Milwaukee 1, Wis.



Power Supply

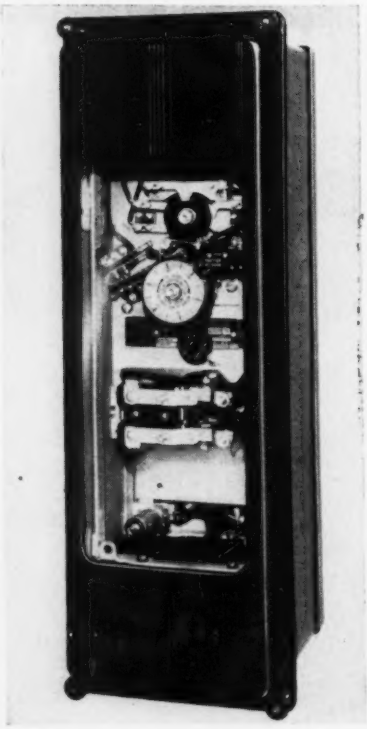
Two emergency ac power supplies with rotary converters as the main component have been announced. They operate from 24 or 48-v storage batteries and have a rated output of 250 watt 110 v ac to supply uninterrupted power for a three-channel carrier terminal, a carrier repeater, or a small radio station.

Automatic transfer to emergency source is completed within ½ sec after failure of normal ac power. Load can be returned from the power supply to the normal source either automatically or manually when power is restored.

Lenkurt Electric Co, San Carlos, Calif.

Reclosing Relay

A redesigned automatic reclosing relay (RC) with a built-in instantaneous trip lockout feature has been announced for controlling circuit breaker reclosing. The RC will prevent repetitive tripping due to the instantaneous trip of the protective relay.



Additional external terminals provide connection to internal coils and contacts to permit relay application to all circuit breaker control schemes. Adjustable reclosing time sequences of 60, 90, 180, or 360 sec are provided by a 600-rpm synchronous motor with a gear train of adjustable ratio. Relays may also be obtained with an adjustable integrating lockout device that limits successive circuit breaker reclosures to a safe value.

Westinghouse Electric Corp, Pittsburgh 30, Pa.

Wire Wrapper

A new tool for wrapping stranded or solid wire around terminals has been announced. One or more wires can be wrapped with a single twist of the wrist, it is claimed. The tool is used in the following manner:

1. Wire is placed against the terminal.

2. Tool is placed over the terminal so that the wire is caught in the notch of the tool.

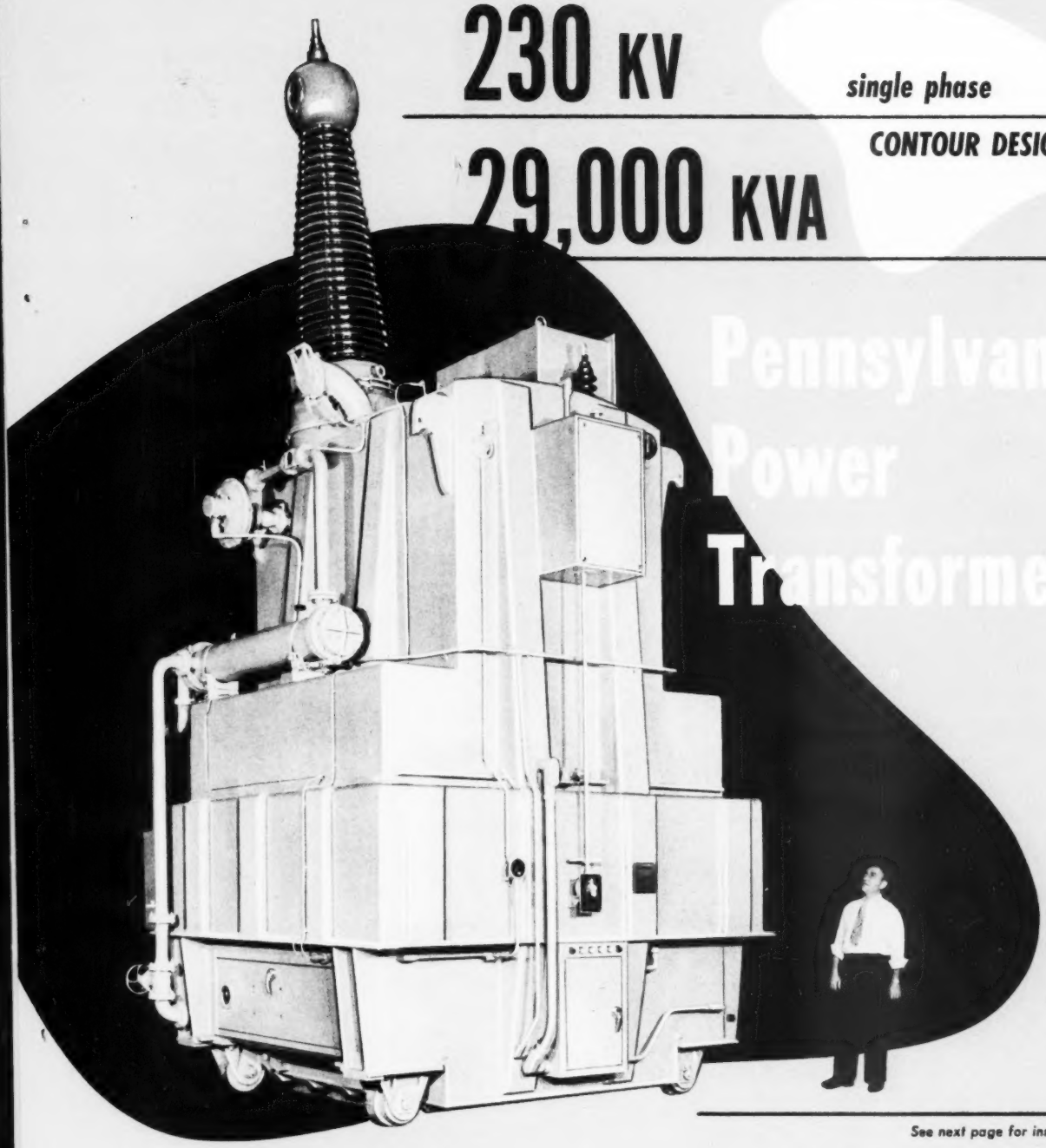
3. Twisting motion is applied, wrapping the wire around the terminal in a neat tight connection, ready for soldering.

230 KV

single phase

CONTOUR DESIGN

29,000 KVA



See next page for inside story

Six of these shell form, Contour Design 230 Kv Pennsylvania Transformers were shipped to a power project on the West Coast to form two 87,000 Kva banks. The transformers traveled by train in an *upright position, completely assembled* except for bushings. Rated individually at 29,000 Kva, single phase, the transformers are designed to step up a generated voltage of 13,200 volts to a transmission voltage of 230,000 volts. Low operating temperatures are maintained in the transformers by means of forced-oil—forced-water heat exchangers.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

Inside a 230 KV 29,000 KVA Pennsylvania Power Transformer

single phase

CONTOUR DESIGN

Upper Contour Design tank section fits over coil and core assembly and is welded to the bottom tank section.
Core and coils clamped together with heavy steel frames to form a rigid structure.
Heavy box sections form part of core frame and clamp coils against mechanical forces during short circuits.
Core and coil assembly rests on bottom section of the Contour Design tank.
Core and coil unit can be handled separately as a complete sub-assembly.
Vertical cooling ducts in the coils permit a free flow of oil through the coils for most efficient cooling.
Core cooled by both vertical and horizontal ducts.

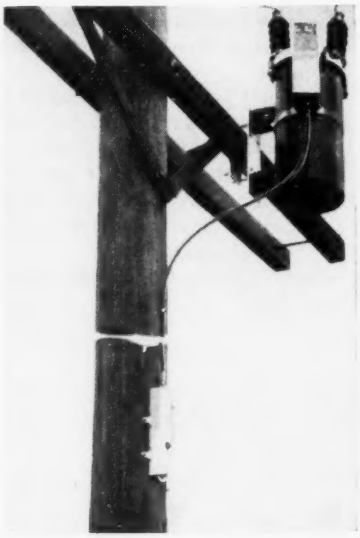
PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

For exterior view of this transformer, see other side.

Auxiliary feature of the tool is a drilled hole and milled flat to be used for putting a hook in a wire. Tool can also be used for straightening bent terminals. Three sizes are available. **Contact, Inc, Cambridge 42, Mass.**

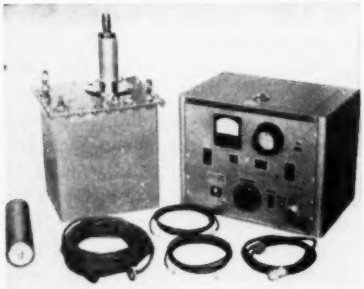


Recloser Control

An oil circuit recloser remote control has been announced that is applicable to most 15 or 25-kv single-phase reclosers. It is available with a 10, 15, 20, or 25-ft flexible control shaft.

Remote control handle housing is slotted. This is said to permit operation with a switch stick but prevents hand operation.

James R. Kearney Corp, St. Louis 10, Mo.



Corona Test Sets

Two corona test sets have been announced. They consist of a control unit, a detector unit, and a high voltage corona-free testing transformer, which incorporates means for picking

For a gayer, brighter Christmas use

COLORBEAMS

STORE DISPLAYS and store fronts brilliant with color! Gorgeously-hued flood lighting by organizations . . . business and industrial concerns . . . municipalities! This is the year to "paint the town" . . . to set it a-sparkle with the colorful radiance that typifies Christmas at its gayest. And Amplex Colorbeams are a *natural* for achieving this with topmost ease and effectiveness.

Amplex Colorbeams come in a choice of 14 striking colors and a full range of sizes and wattages. The color is an integral part of the glass . . . will never fade, chip or crack. The sealed-in reflector linings are pure silver and provide maximum light intensity. And Colorbeams have a rated average life of 2000 hours!

To spark the Christmas spirit and crown the season with color, write for the whole story on Amplex Colorbeam Reflector Lamps. **Amplex Corporation, Dept. J-11 111 Water St., Brooklyn 1, N. Y.**

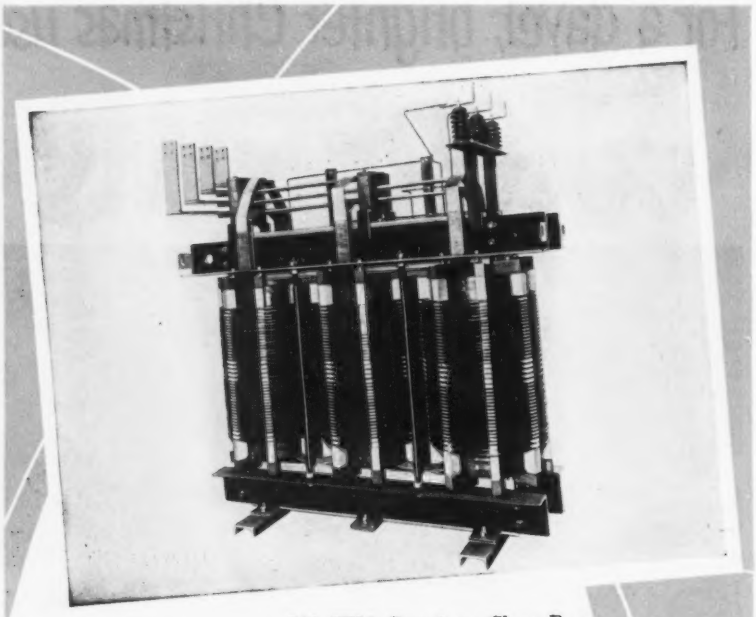
R 30
for indoor use

R 40
for indoor use

Par 38
for outdoor-indoor use

AMPLEX

Incandescent, Fluorescent, Sealed-Beam Reflector, Infra-Red, Rough Service, Mercury Vapor, Photoflash, Street Lighting and Traffic Signal Lamps, Swivelites, Hi-Hats and Display Lighting Accessories.



500 KVA Dry type Class B insulated 80° C rise core and coil assembly 13800 V Delta to 208 Y/120

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is the result of specialized research and sound design. Rigidly controlled materials and modern production facilities are additional guarantees of the quality of our products.

Our field organization and our staff of application engineers at Akron will be glad to help you on all your transformer and substation problems.

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STOCKWELL TRANSFORMER CORP.

AKRON, OHIO

OIL-FILLED, DRY TYPE, and ASKAREL-FILLED DISTRIBUTION AND POWER TRANSFORMERS

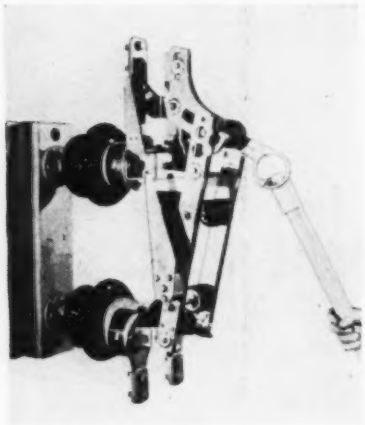
3-1

up corona signals from the equipment under test.

In operation, equipment to be tested is connected to the testing transformer high-voltage terminal. A 60-cps test voltage is increased until corona indication appears on the cathode ray tube in the detector unit. The rms equivalent of peak voltage is then read from the adjacent peak voltmeter.

Model 1 is rated 0.75 kva, 20 kv continuously or 1.5 kva intermittently. It is also available with a larger control unit with rating of 2 kva continuous and 5 kva intermittent. Model 2 is rated 10 kva, 35 kv continuously or 20 kva intermittently.

James G. Biddle Co, Philadelphia 7, Pa.



Regulator Switch

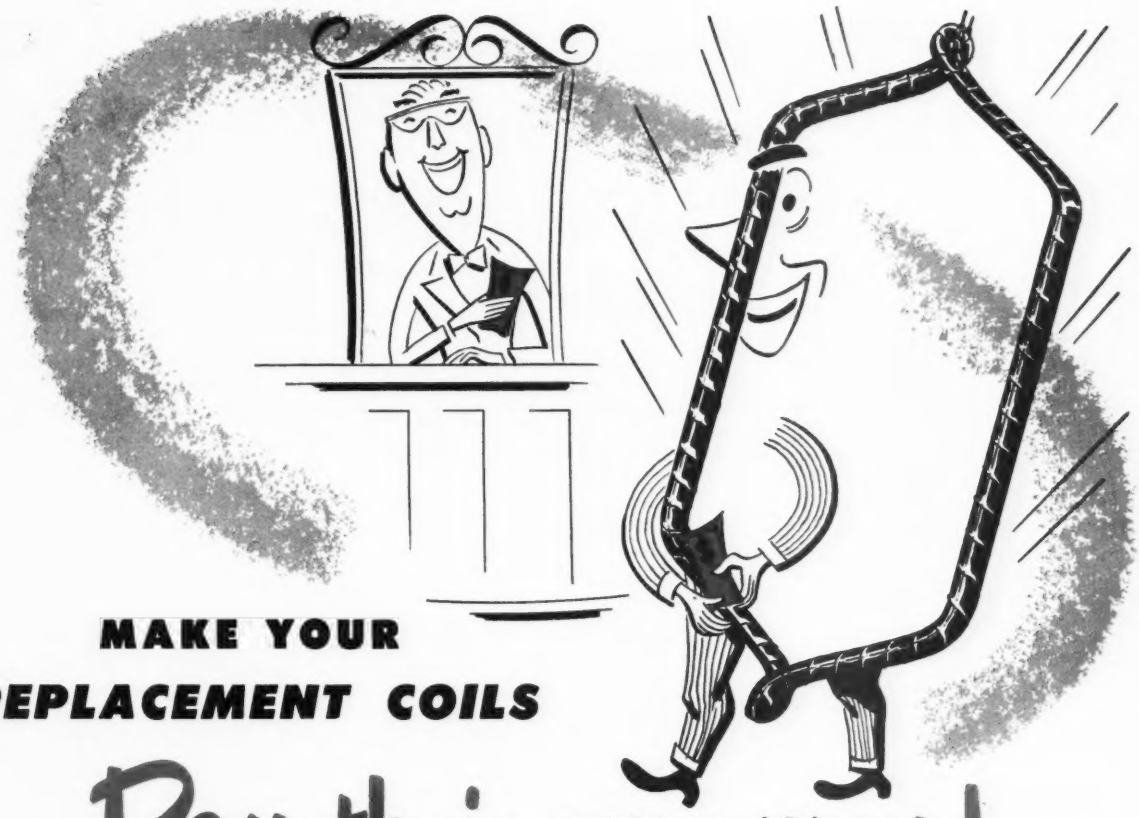
A new bypass switch for use with voltage regulators on 7.5, 15, and 23-kv distribution circuits has been announced. It is said to do the work of three switches in isolating or reinserting regulators.

When a lineman opens the switch with a hookstick, contacts operate in sequence by first shunting the regulator and then disconnecting it from the line. The switch has a load current rating of 600 amp and will handle short-circuits currents of 20,000 amp.

Westinghouse Electric Corp, Pittsburgh 30, Pa.

Insulating Varnishes

A new series of Class H silicone electrical insulation varnishes have been announced. Their applications



MAKE YOUR REPLACEMENT COILS Pay their own way!

An electro-metalurgical producer is drawing a large annual power bonus because National maximum-capacity design boosted the capacity of his generator by 15.9 per cent. Increased output will pay for the complete rewinding job in a little more than two years.*

"As good as new" is *not* good enough for National. A generator or motor with National replacement windings *must be better than new.* Every phase of National engineering and production is directed toward this objective.

Redesign for maximum capacity is typical of extras you can count on from National. Where increased output can be used or sold, National replacement windings will pay for themselves over a very short period of time. Where it cannot be utilized, extra capacity reduces operating temperatures and results in substantially longer coil life.

If you operate heavy rotating electrical equipment for any purpose, you can operate it more profitably with National windings. Get in touch with your nearby National field engineer today. Find out how National maximum-capacity design and National extra-quality coils can help your motors and generators do a better job.

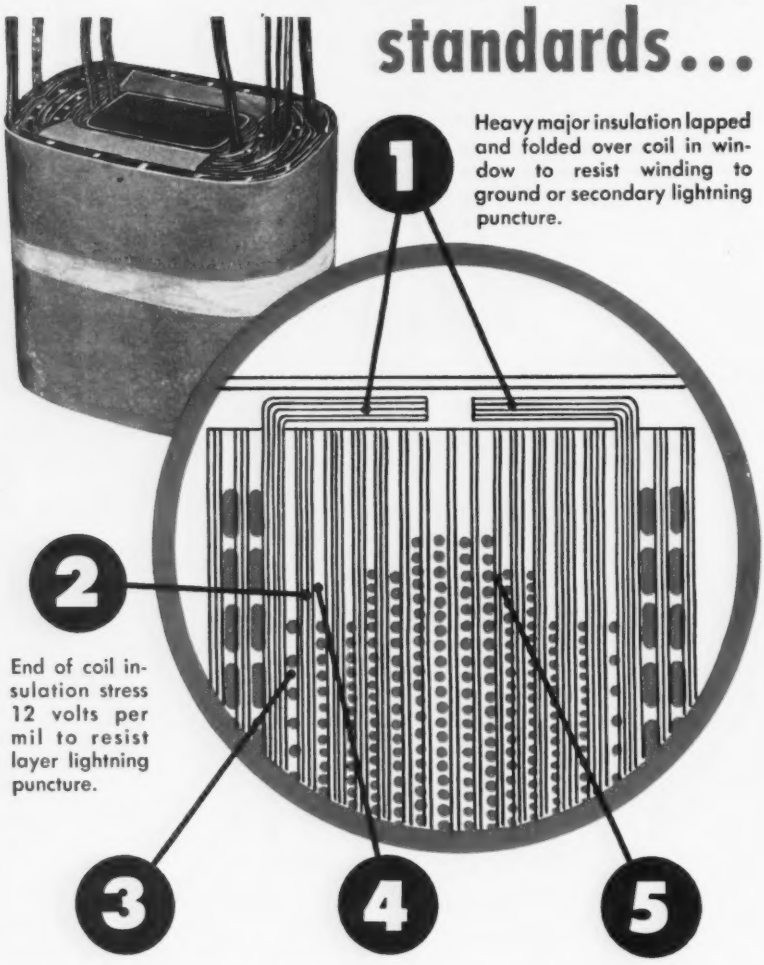
*Complete details on this installation available on request.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

WHY RT&E transformers have impulse levels 150-200% NEMA standards...



1 Heavy major insulation lapped and folded over coil in window to resist winding to ground or secondary lightning puncture.

2 End of coil insulation stress 12 volts per mil to resist layer lightning puncture.

3 End layer space wound to resist turn to turn lightning failure.

4 End of coil layers spaced back from coil edge to resist winding to ground lightning puncture.

5 Center of coil insulation stress 40 volts per mil — taps located at coil centers and remote from lightning entrance points.

Impulse tests to destruction show levels of 150% to 200% of industry standards.

All R T & E coils are varnished, baked, vacuum dried and oil impregnated for insulation resistance in excess of 10,000 megohms.

When you buy, specify **R T & E**

WRITE FOR CATALOG

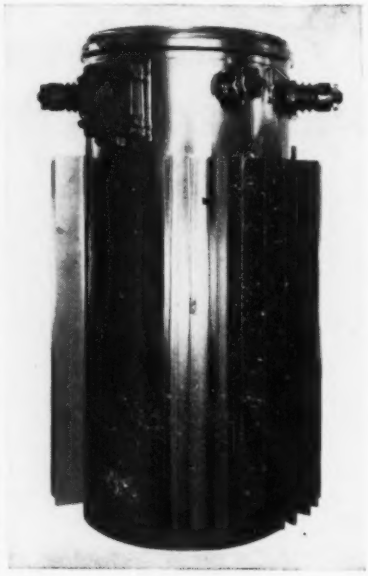
632 N. 8TH ST. MILWAUKEE 3, WISCONSIN

RT&E Co.

BRANCH PLANT: WAUKESHA, WISCONSIN

range from flexible glass cloth or tape to rigid tubular transformer insulation.

Coating varnish R-61, intended for glass cloth and tape, will meet requirements of either Class I or Class II silicone insulation under Military Specification MIL-I-17205A. Impregnating varnish R-62 is used in the coating of electric coils, armatures, and stators. It is said to permit temperature rises in electrical equipment for continuous operation at Class H temperatures, or limited operation at 480F. Thermosetting resin R-63 is used as a bonding resin for asbestos, glass, mica or other mineral filler, and as a protective and release coating. **Linde Air Products Co, New York 17, N. Y.**



Lighting Transformer

A new light-weight constant-current street lighting transformer has been announced. Models up to and including 20 kw are designed for direct pole mounting.

A new coil design is said to eliminate the counter balance and introduces parallel straight line motion. The unit has fast response as friction is limited to one main roller-bearing assembly and one guide assembly. Alnico magnet compensating assures a flat regulation curve.

Insulation consists of paper and cotton on the conductors, kraft paper between layers, and impregnated with a water-proof compound. Baked on Glyptal paint provides an oil-proof

SEND FOR THIS 32 PAGE MULTICLONE BOOKLET

HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

This booklet shows...

MULTICLONE'S SPACE SAVINGS...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

MULTICLONE'S ADAPTABILITY...How the Multiclone is more adaptable to varying inlet-outlet requirements—to varying space limitations—and is simpler to insulate, thus reducing installation costs!

MULTICLONE'S EFFICIENCY...How Multiclone's multiple *small diameter* tubes, made possible by its exclusive vane design, give higher centrifugal forces and more complete cleansing of *all* suspended particles—even small ones of 10 microns and less!

MULTICLONE'S LOW MAINTENANCE...How the Multiclone has no high speed moving parts to repair or replace, no pads or filters to clean or renew, nothing to choke gas flow or increase draft losses as suspended materials are recovered. Multiclone draft losses remain uniformly low—recovery efficiencies uniformly high—at all times!

Make sure that a copy of this helpful booklet is in your reference files by sending for your copy now!

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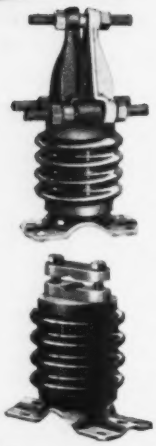
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

3E

INDOOR BUS SUPPORTS

prompt shipment
uniform high quality
easily altered or replaced



Fabrication from unit assemblies of components insure early delivery dates and uniform quality.

3E Bus Supports come in a wide range of styles and sizes for bar cable or tube conductors in flat or 1¼" pipe mounts, for voltages up to 23,000 volts.

For full data ask for New Bulletin 226

ELECTRICAL ENGINEERS EQUIPMENT CO.
Melrose Park, Illinois

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When you're planning a power plant, electrical substation or transmission tower, you'll find Flint has the steel and "know how" you need. ONE Call to Flint will handle your entire job.

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FLINT STEEL CORPORATION
P. O. BOX 1289 TULSA, OKLAHOMA

finish. An outside handhole, located above the transformer's oil level, provides easy weight adjustment. Covers can be removed by loosening one bolt holding the clamp band.

Any type of lamp load can be used on the transformer. Harmonic distortion caused by discharge lamps is reportedly eliminated because of the transformer's high reactance.

General Electric Co, Schenectady 5, N. Y.

MORE NEW PRODUCTS

about which you should know

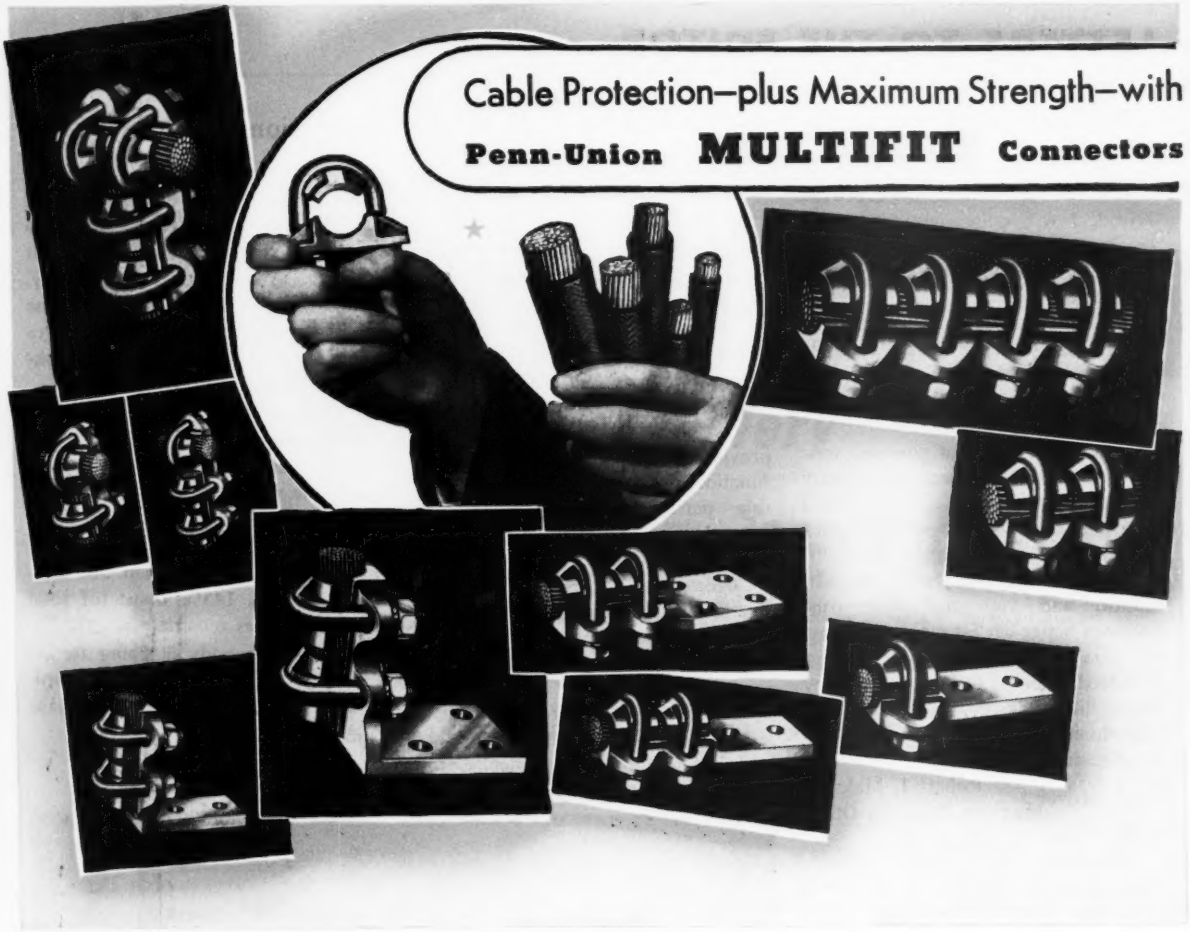
E. D. Bullard Co, San Francisco 3, Calif., announces a **crane hook** with a safety gate that locks automatically and will not open unless the pin is manually depressed . . . National Electric Products Corp, Pittsburgh, Pa., has a line of electrical **metallic tubing** with an electro-galvanized exterior and aluminum enameled interior. Sizes range from ½ through 2 in., in 10-ft. lengths.

Amplex Corp, Brooklyn 1, N. Y., announces a R57 **reflector lamp** for industrial high-bay lighting applications, which are available in 500 and 750-w models . . . Bustin Firm-Grip Grating Corp, New York 37, N. Y., has a new light-weight **non-skid grill** for use on platforms and stairs.

Superior Flux & Manufacturing Co, Cleveland 13, Ohio, announces a silver **solder paste flux** . . . Thomas & Betts Co, Elizabeth, N. J., has **insulated sleeves** for electrical conduit connections that are made of a split fibre tube.

Dee Electric Co, Chicago 22, Ill., announces a **solder pot** for temperatures from 300 to 600F and requiring a 110-v, 800-w power supply . . . Ilsco Copper Tube & Products, Inc, Cincinnati 27, Ohio, has molded **terminal blocks** that can be combined to make up to 25 poles.

Line Material Co, Milwaukee 1, Wis., announces a constant wattage **ballast** for use with EH-1 mercury vapor lamps . . . Combustion Control Corp, Boston, Mass., has a new **flame control** to protect against flame failure explosions.



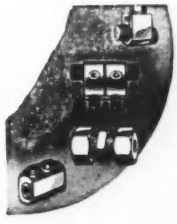
The design of Penn-Union Multifit Connectors retains the full strength and rigidity of the silicon bronze bolt. The saddle which provides a wide surface to grip and protect the cable is permanently fastened to the U-bolt; one piece. *The strongest and most satisfactory fitting of this type.* High copper content alloy; silicon bronze Nuts and Lockwashers as well as Bolts. . . . ★ Each Multifit Connector takes a wide range of conductor sizes; only a small stock will provide for many needs. Made in a complete range for cable up to 2,000,000 cm.

The Penn-Union Line also includes numerous other types of Tees, Lugs, and Straight Connectors, as well as Service Connectors, Bus Supports, Grounding Clamps, Cable Taps, etc., etc. Experienced users have found that the Penn-Union mark on a fitting is the best guarantee of satisfactory performance.

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd.
250 Richmond St., West, Toronto



THE *Complete* LINE OF CONDUCTOR FITTINGS

PENN-UNION

LETTERS TO THE EDITOR

Was It Worth It, After All?

To the Editor:

When I subscribed to Electrical World, I was quite prepared to see the banner of private power waved—but had not anticipated the extent nor exclusiveness.

Your reference to Harry Truman in the September 14th issue certainly convinced me that I can expect no fair presentation of the public vs. private power question.

I don't feel bad that you and your magazine hold to such reactionary theorems—but I do feel bad that I was a chump enough to spend $12 for a partisan propaganda sheet.

The giveaway and grab is on, Mr. Editor, and you and your trust brethren better get fat quick—because the time you'll have at the pie counter is indeed going to be short. The very same "little" Harry that you would ridicule may very well be instrumental in checking the larceny.

Robert J. Maloney
Manager, Madison Office
Sioux Valley Empire Electric Association, Inc
Colman, S. D.

Uniformity on Connectors

I would like to address an open letter to all electrical connector manufacturers and to all users of electrical connectors. I think it will be agreed the various names by which the many materials or compounds that are applied to a conductor and/or connector to improve or stabilize the electrical circuit at that point are not descriptive of their functions, are many times misleading, and are far from standardized in usage.

Such terms as protective compound, inhibiting compound, connector compound, connector "goop", can be heard at both technical meetings and on pole tops and appear abundantly in our technical literature. They are both confusing and inadequate. It is high time the industry made an attempt to standardize a properly descriptive set of terms by which any type or kind of connector aid manufactured can be accurately classified.

I propose such a set of descriptive designations for appraisal by those who are interested in this problem. My proposal has merit, I believe. However, the designations given may be improved upon, I am sure.

Connector aids:

- **Sealing paste:** A jell-like paste to keep air, moisture, etc, from the contact area. Examples: Neutral greases, heavy-bodied jells, extensible films.
- **Contact aid:** Metallic grit in a light vehicle; field-sprayed metallic surfaces; active etching preparations.
- **Sealing-contact paste:** A material providing a combination of the above functions. Example: A metallic, cutting particle incorporated into a heavy-bodied neutral grease or other extensible medium.
- **Coverall:** An enclosure over the entire finished connection. Examples: molded on plastic covers; self-sealing, hand-applied mastic compounds; tape; sprayed-on films.

E. W. Greenfield, Head
Electrical Engineering Department
Kaiser Aluminum & Chemical Corp

Confusion in Yugoslavia

To the Editor:

While in Yugoslavia for the IEC meeting last June, I was given a booklet on power production in that country. When I read the story, "Yugoslavia to Export Power" in the Sept. 14 issue, I checked the figures in the story against those in the booklet and found a discrepancy.

According to the booklet, the statement in Electrical World on 1939 and 1952 production is incorrect. To correct it the words which I have placed in parenthesis should have been a part of the statement: "The 1939 (hydro) production reached 500 million kwhr. A 145% boost (of total production) was recorded in 1952."

I suppose nobody is going to get excited about this. It is for the record.

P. H. Chase
Philadelphia Electric Co
Philadelphia, Pa.

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(TITLE)
SAMPLE

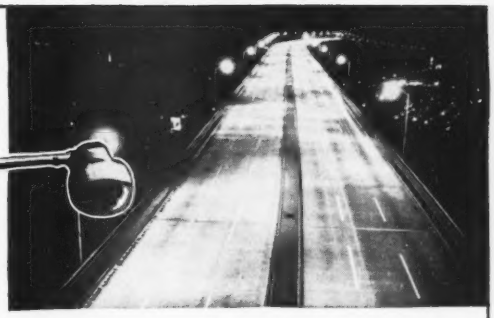
No Sooner Said Than Done

To the Editor:

I have just read a copy of the July 20th issue of Electrical World and want to express my thanks both for the article on our program and for the cover featuring this program.

The last sentence of the article mentions the possible use of a company driver permit. Since the article was written, we have taken this step. Our qualification tests are being made equivalent to the state requirements for issue of chauffeur's licenses for various classifications of trucks.

E. F. Hockenbeamer
Safety Supervisor
Pacific Gas & Electric Co



FATHER WASHINGTON BRIDGE

Night becomes day with super-modern lighting. P & K All-Aluminum standards are mounted on steelwork and have 30 foot mounting heights with 6-foot tapered elliptical arms.

the P&K *story*

on the New Jersey Turnpike

The New Jersey Turnpike is a twentieth century miracle of highway design, engineering and construction. Here is one hundred eighteen miles of continuous road ... without a single traffic light or crossroad!

Within one year after its lanes opened, the "Pike" carried the amount of traffic predicted for the year 1968 ... and its safety record is better than parallel public highways in the state as well as most public roads in the nation.

This great national artery employs every known improvement and device to provide maximum safety for its users ... and its facilities are being expanded to meet increased traffic demand.

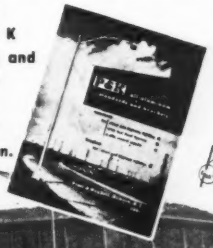
Lighting, modern and efficient, turns night into day on the New Jersey Turnpike ... and Pfaff & Kendall is proud to have been chosen as the original supplier of all highway and area lighting facilities throughout the entire 118 mile length of the highway. P & K All-Aluminum Standards and Arms have been specified and thus far have been the only type installed.

P & K ALL-ALUMINUM Standards and Brackets are Produced in Design and Types to Meet any Street, Road or Highway Requirement. They are Always the Wisest Investment ...

- .... much lighter weight *for lowest installation costs*
- .... negligible rate of corrosion *for longest life*
- .... no painting *for initial and lifelong savings*
- .... easily salvaged and re-used *in event of knock-down*

WRITE FOR LATEST P & K CATALOG

and use the P & K Planning and Advisory Services without obligation.



THE NEW JERSEY TURNPIKE

looking toward Laurel Hill and the Lewandowski Bridge crossing the Hackensack River. The P & K All-Aluminum Standards have 30 foot mounting heights, with 15 foot All-Aluminum Tapered Elliptical Arms, and Transformer Bases.

Pfaff & Kendall

84 Foundry Street
Newark 5, New Jersey

IF YOU THINK ALL

First Aid Kits are alike, we've got news for you! To produce a First Aid Kit that would serve you better, we "put the finger" on every place where modern design, latest Quality Control, color keying, and improved manufacturing techniques would bring you important *extras* in First Aid Kit quality and performance.

Then we MADE these improvements. Many of the changes are small in themselves, but they add up to a big difference. Let us prove to you that we have something different . . . something you don't want to miss!

FIRST AID KITS ARE

often a major factor in emergencies. Freshness, purity, and sterility of every treatment contained in Unit "D" packages is covered by our quality control program which assures pharmaceutical thoroughness, unit responsibility.

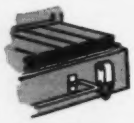
And our quality approach doesn't end here. Some would claim that appearance and package instructions were minor in value . . .

JUST THE SAME–WE'VE

extended our "make it better" program to a dressing-up that pays off in convenience, use. Our new blue color gives case and packages a clean, distinctive appearance. Hard wearing surface of baked enamel on the case resists grease, dust. New, easy to read identifications and simplified instructions on many of the packages aid users. And our labeling meets the latest requirements of the U. S. Pharmacopeia and Food and Drug Administration.

GOT NEWS FOR YOU

too, in our case design. No overlapping lid to complicate handling, storage. Packages extend above the edge of the base, giving "finger room" for quick removal of any package. Tubular rubber gasket fits in metal channel in base, adds extra pressure, more contact surface when lid is closed. Truly an M.S.A. "All-Weather" feature.



You'll find news in our first aid materials, too. M.S.A. Visual Swabs have gauze tips which are less absorbent to assure full utilization of antiseptic. Color keying of labeling assures positive, quick identification. Ammonia Inhalants contain pure, uncolored solution and are tested against leakage before shipment. Our Ammonia Ampoules feature a "color break" line that gives a clean, quick break. Label is printed on both protective sleeve and glass vial to safeguard against mis-use should sleeve be lost.

MSA
SAFETY EQUIPMENT HEADQUARTERS

AND THERE'S MORE, LOTS MORE . . . but seeing is believing. So call your M.S.A. man today for a demonstration. It's BIG NEWS!

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pa.
82 Branch Offices in the United States and Canada
Cable Address "Minsaf"

WHAT THEY'RE SAYING

At Industry Meetings

Tax Must Remain Big Ratemaking Factor

JUSTUS F. CRAEMER, California, for a special committee on the effect of taxes on utility rates at the National Association of Railroad and Public Utilities Commissioners annual convention in New York City

Obviously, taxes are necessary for government to carry on its functions. Reduction in the volume of taxes is only possible if government expenditures are curtailed. In the absence of such curtailment any decrease in the amount of taxes which are measured by utility plant and revenues must be accompanied by a corresponding increase elsewhere. Accordingly, unless and until government expenses—local, state, and national—are reduced, there seems to be little likelihood of reduction in the total volume of taxes. As regulatory bodies we must thus continue to recognize tax expense, as incurred, when determining rate levels.

'Preference' Must Imply Reasonable Alternatives

CLARENCE A. DAVIS, solicitor, United States Department of Interior, before the 35th annual meeting of the Public Utilities Association of the Virginias, White Sulphur Springs, W. Va.

The preference clause, as you know, is another clause which has occasioned a great deal of controversy in its administration. My views as to its interpretation have not yet been stated to any degree of nicety, but preliminarily, it seems to me that the word "preference" must imply a choice between reasonably comparable alternatives, and that preference does not mean exclusion of alternatives before exercising the preference.

There is one aspect of the preference clause on which the department has already made a decision. Can large industrial users, by the device of making a contract with a preference customer, draw away into industrial uses blocks of power that are otherwise needed for the use of domestic and rural consumers? It has seemed to me that to so permit, without some limitation, defeats the clear

(Continued on page 162)

WE MAKE OUR OWN RAIN . . .

Victor No. 245-R Transmission Pintype undergoing standard EEI-NEMA wet flashover test in the Victor Laboratory.

TO GIVE YOU

PROVEN WET WEATHER PROTECTION

The superiority of Victor design and manufacture is proven in the laboratory as well as in the field. Take Victor High Voltage Pintypes, for example. Here, in the wet flashover test shown above, the insulator is being subjected to controlled artificial rain while 60-cycle current is applied in gradually increased voltage steps until flashover occurs.

This is only one of the many tests which are constantly being made in the Victor Testing Laboratories to assure you of highest quality and conformance to specifications. That is why Victor Transmission Pintypes give you proven wet weather protection and longer, trouble-free service on your lines. Choose Victor — the power man's best buy!

VICTOR No. 245-R
EEI-NEMA Class 56-3

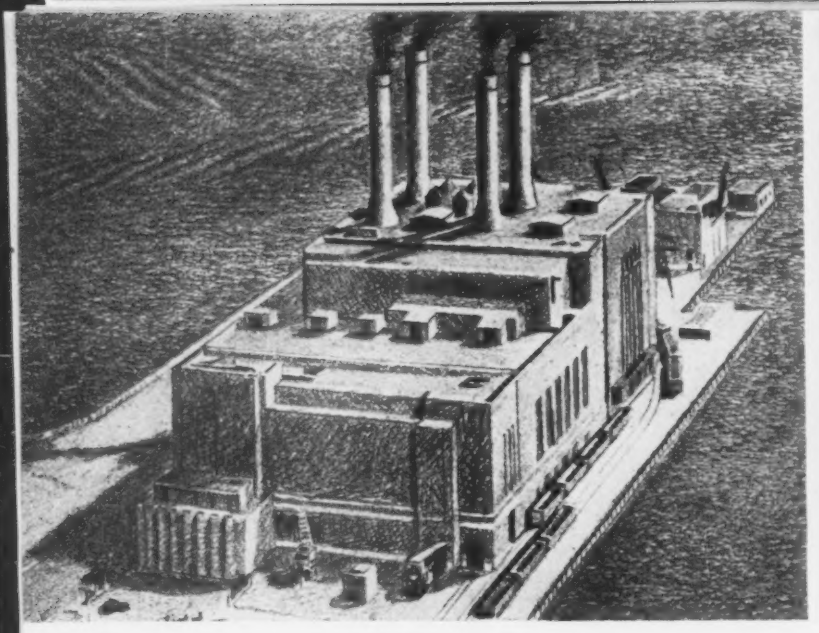
FREE BOOKLET gives you the full story of how Victor Insulators are made how and why Purified Porcelain was developed. Write us for your copy.

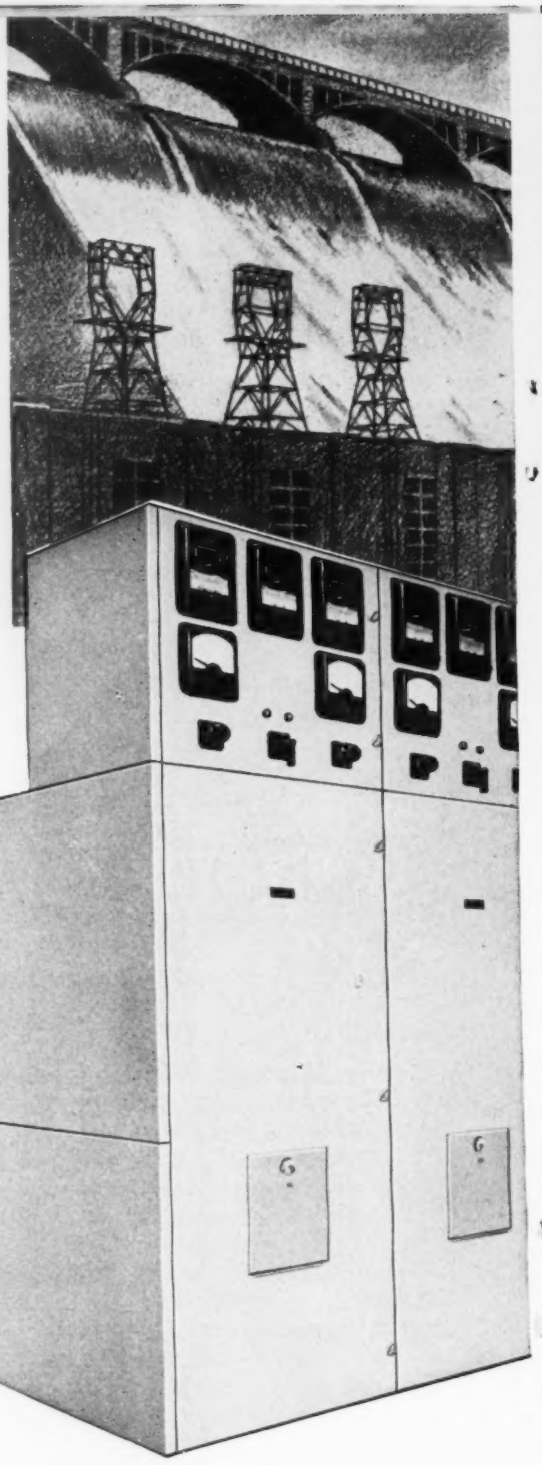
Specify

VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Porcelain





A TRILLION KWHR by 1965*

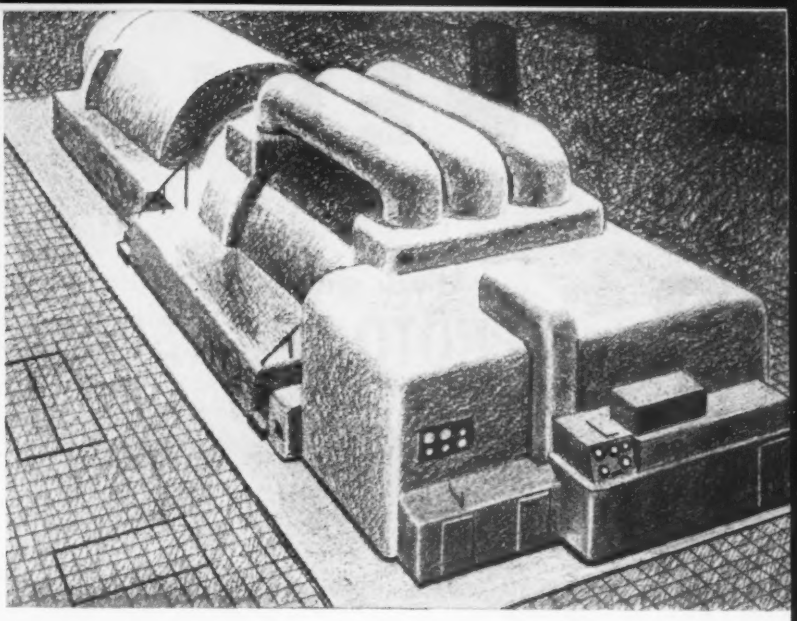
I-T-E is pacing America's greatest electrical expansion

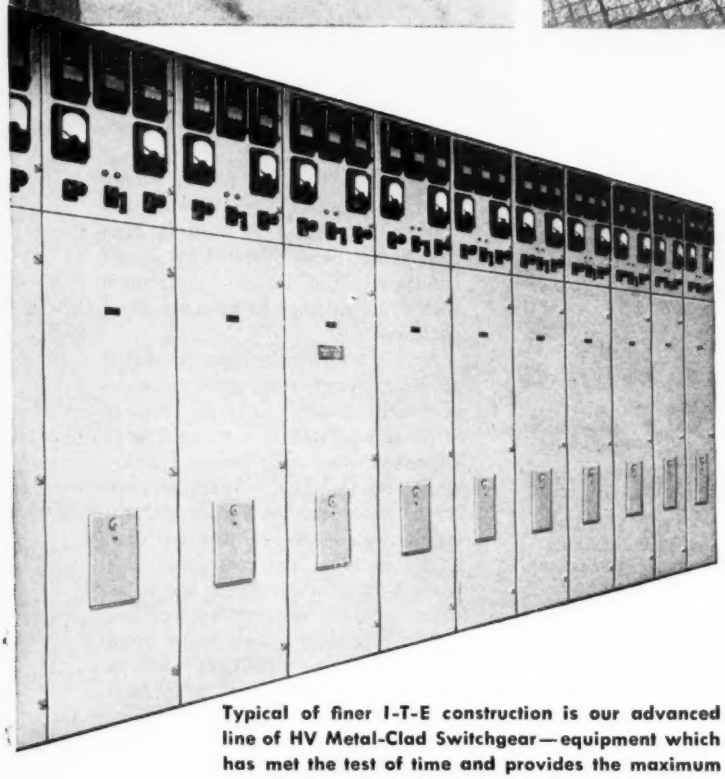
KWHR capacity has doubled in the past ten years and present trends indicate another doubling in the decade to come. New power generation, transmission, and distribution equipment—more of everything—will be required to handle this increased capacity.

In the past ten years, I-T-E has expanded some twenty fold—supplying quality switchgear for every type of industrial and commercial application. Look for even bigger strides forward—broader lines, more products, finer designs, and increased production—as I-T-E continues to pace America's greatest electrical expansion.

**Edison Electric Institute*

THE SYMBOL OF QUALITY SWITCHGEAR





Typical of finer I-T-E construction is our advanced line of HV Metal-Clad Switchgear—equipment which has met the test of time and provides the maximum in protection and efficiency at a minimum over-all cost.

For details, call the I-T-E field office nearest you. Look in your classified telephone directory under "Electrical Equipment."

Or—write for **Bulletin No. 7004B.**

I-T-E Switchgear embodies...

- advanced engineering
- refined design
- quality construction

Through 65 years, the I-T-E Circuit Breaker Company has achieved outstanding recognition in the industry by persistent effort to advance the switchgear art.

Many switchgear "firsts" are attributed to I-T-E, among them:

- the original Inverse Time-Element (I-T-E) circuit breaker
- the first enclosed circuit breakers and switchboards
- the first high-voltage air magnetic circuit breaker
- the first isolated-phase bus

In addition to the introduction of new ideas and thinking, I-T-E has devoted its engineering skill to accomplishing the ultimate in design and production refinement.

I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.

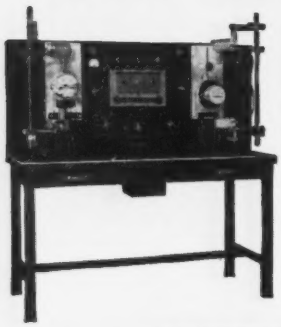
I-T-E Metal-Clad Switchgear

SUPERIOR

SUPERIOR

Check with Superior on

PHOTO TEST TABLES



• Superior's new dual position, photo-electric test table . . . a great time and money saver...one of various standard Superior types. Superior also makes *any* type of special testing equipment to specification. Write to:

SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of The Union Metal Manufacturing Company

Convert Your FORD TRUCK with a

Tel-E-Lect

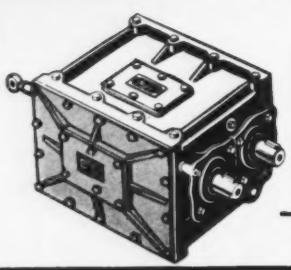
DERRICK-DIGGER KIT

Now there's a Tel-E-Lect Derrick and Digger mounting assembly tailored for the front end of your Ford truck. Cab-controlled, it will handle poles up to 40' long, requires only two men to handle and can easily be attached to your Ford by your local mechanic. Digs holes and sets poles, with interchangeable auger sizes from 8" to 20". *Send for bulletin describing all three models to suit your job requirements.*

Makes It Easy For TWO MEN To Solve Tough Pole Line Problems

Forward and Reverse Transmission

This unit is included in all Ford conversion kits. Enables the operator instantly to raise or lower either the winch line or derrick. Gives instant forward or reverse rotation to the winch without shifting PTO, and without using the truck clutch.



Earth Boring Equipment for All Types of Trucks

Tel-E-Lect PRODUCTS, INC.

10003 Minnetonka Boulevard
Minneapolis 16, Minnesota

(Continued from page 158)

mandate of Congress that federally produced power shall be "for the benefit of the general public and particularly of domestic and rural users," and that contracts should be so drawn that in the event of shortage, the general public shall not suffer for the benefit of the few.

Public-Private Rate Differential to Dwindle

FRED G. AANDAHL, Assistant Secretary of Interior, at Missouri Basin Inter-Agency Committee Meeting, Fargo, N. D.

Both by the affirmative statements in the present power policy and also by omission of provisions that were in the previous power policy, it is apparent that it will be the federal government's purpose to dispose of federal power in communities in such a way that it will not disturb established retail systems.

At the local level people should determine for themselves whether they want public power or want to have their power needs supplied by private enterprise. The federal government should not attempt to influence these decisions.

So far as federal power is offered at prices lower than power can be produced locally and this power is made available first to preference customers, it of itself creates a desire among local people to become preference customers. As a word of warning, I would like to forecast that, except in high fuel cost areas, five years hence the spread in price between federally produced power and locally produced power, either from steam plants or otherwise, will be much less than it is at the present time.

The matter of power rates is now being carefully reviewed by the Corps of Engineers, the Department of the Interior, and the Federal Power Commission. The rates will be kept at the lowest possible figure, but we must be realistic and recognize the costs and expenses that are properly allocated to power.

It is time that we get away from the idea of giving power away at the taxpayers' expense for the purpose of stimulating local public power and later its absorption by the federal government in an objective headed toward ultimate complete federal government monopoly of power.

Build lines to stay with the CHANCE 8-Way

Most anchor users who have made their own comparisons, their own pull tests, pick the Chance 8-Way Expanding Anchor for holding power and ease of installation.

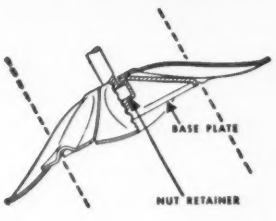
The 8-Way expands to form a complete pyramid shaped square with no wasted space between blades. The guy load is distributed to all eight blades all the way around the hole with up to 63%* of the expanded area in undisturbed earth. The pyramid shape distributes the holding power over a wide area (see sketch).

Chance 8-Way Anchors are available in a complete range of sizes from 60 to 200 square inches in area, for distribution or transmission line guying.

Consult your Chance catalog, or write for complete information, and order from your regular supplier.

*Depending on anchor size.

You GUY with CONFIDENCE when you BUY from CHANCE



ABC INDUSTRIES

A·B·CHANCE CO·

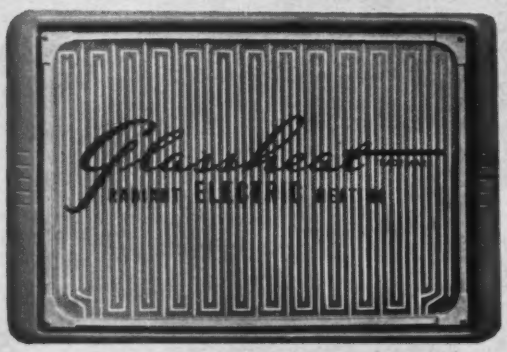
CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

C53-4C

CONTROLLED GLASSHEAT BY CONTINENTAL BALANCES THE YEAR ROUND LOAD

...Pays Off Without Extra Capital Investment



A series of field tests throughout the United States and Canada has proved conclusively that *Controlled* Glassheat by Continental assures highest income from your capital investment.

What is more, further tests proved that with automatic thermostats in each room . . . *controlled* electric heating by Continental . . . the heating load is *behind* the system peak. For example, in Illinois, Continental Glassheat was off the system peak from four to seven P. M. In other areas there was as much as an hour and a half lag between the Continental Glassheat peak and the system peak.

An engineered Glassheat installation permits you to sell an additional 15,000 kilowatts a year to each of thousands of homes in your area. You get this boost in revenue without the necessity for a penny's more capital investment. What is equally important is the fact that because Glassheat is automatically controlled, your normal peak load is never affected.

The power factor of a Glassheat controlled load is 100%.

Progressive utilities throughout the country have found that *Controlled* Glassheat by Continental is a positive, easy way to profit . . . to better satisfied stockholders. It will pay you to investigate *Controlled* Glassheating by Continental. We'll be glad to show you the tests made by other forward-looking lighting companies which resulted in greatly improved load factor and increased revenue through the promotion of *Controlled* Glassheat by Continental.

CONTINENTAL RADIANT GLASS HEATING CORP.
Dept. E N 1, 1 East 35th St., New York 16

Detroit Edison Reveals Changes

Van Duzer is named general superintendent of production. Macomber and Kigar assume new posts in organizational changes

ROBERT M. VAN DUZER

Detroit Edison Co has announced key production and construction appointments and the establishment of two new managerships and several new departments in its central organization.

The utility has promoted Robert M. Van Duzer from assistant chief engineer of power plants to general superintendent of production with the responsibilities previously held by the chief engineer of power plants.

Production Changes . . . Albert C. Pasini, superintendent of the company's new St. Clair Power Plant, was named assistant general superintendent of production. Pasini's former post will be filled by George F. Campau, formerly superintendent of the Marysville Power Plant. Campau is being replaced at Marysville by Clarence H. Clark with Stewart D. Hoetger as Clark's assistant. In another appointment, Ernest V. Rieder, assistant to the superintendent of the Trenton Channel Power Plant, will act as representative for Production Superintendent Van Duzer in matters concerning the personnel organization, design, and construction of Detroit Edison's River Rouge Power Plant.

Changes in the utility's construction organization include the appointment of Henry E. Macomber, former chief engineer of power plants, as manager of construction and Ronald E. Greene, former construction engineer, as assistant manager of construction.

The Construction Department was renamed the Construction and Maintenance Department. George J. Brown, former assistant construction engineer, has been appointed general superintendent of the new group with Lloyd J. McPartlin as assistant general superintendent. The Engineering Division of the Construction Department, headed by Supervising Engineer Simon Roth, was transferred to the manager of engineering, Howard P. Seelye.

Heads New Department . . . Donald F. Kigar was named manager of union relations in charge of the newly formed Union Relations Department. Kigar, formerly manager of construction, will have full responsibility for all matters relating to unions in the company.

Sylvester F. Leahy was given the new title of manager of employee relations. He will also continue his former responsibilities as director of employee relations.

Detroit Edison's new Civil Defense Department will have Harold B. Tyree, former assistant to Pres Walker L. Cisler, as its director. Ernest W. Spring was made assistant director of the Civil Defense Department. He will, however, continue his duties as a staff assistant in the company's electrical system.

•

William A. Patterson, manager of the Longview, Wash., office of the state employment security department for the past eight years, has been named to a new job as administrative assistant to Glenn Hittle, manager of the Cowlitz County Public Utility District. He will have charge of personnel and public relations.

PAUL V. HAYDEN

Connecticut L&P Names Hayden Employee VP

Paul V. Hayden has been named vice president in charge of public and employee relations for Connecticut Light & Power Co. He succeeds A. S. Jourdan, who retired after 43 years of service. He had been a division manager until assuming the employee relations vice presidency.

Hayden joined Connecticut L&P in 1929 after serving with Westinghouse Electric Corp following his graduation from Brown University. He was assigned to industrial power engineering and became industrial manager in 1948.

He was named executive assistant in the public relations department in 1950 and in December of that year became director of public relations.

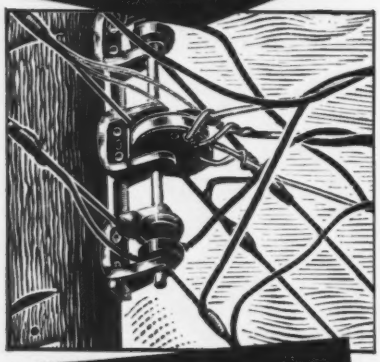
•

F. E. Lieb, who was chief electrical engineer for Copperweld Steel Co for the past 3½ years, has been named manager of sales of the company's Wire & Cable Division. At the same time, **R. C. Ridley** has been named assistant manager of sales, **C. C. Sowards** eastern sales manager, and **E. G. Elg** western sales manager.

James S. Hamilton, formerly manager of Virginia Electric & Power Co at Portsmouth, has been appointed director of rural sales with headquarters in that city. He is succeeded by **G. Fred Cook, Jr.,** who has been director of the company's employee

Four-In-One
SPOOLS
For multiple service take-offs

REDUCE
SHOCK HAZARD



CUT
LABOR COSTS

Engineered *specifically* for multiple service take-offs, Porcelain Products' Four-In-One Spools do *even more than* reducing shock hazard and saving labor. They save over a foot of conductor on each drop! They eliminate "feed backs" . . . reduce radio interference. They make possible even distribution of sag . . . permit service or secondary changes without one interfering with the other. They're a *practical* investment that will help your line and service crew.

Write for descriptive literature.

Porcelain Products, Inc.
FINDLAY, OHIO

information program for the past 14 months. Cook's replacement is **P. W. Smith,** formerly director of residential sales.

Fred L. Witsell, who has been vice president in charge of employee relations for Public Service Co of Colorado since 1948, has been elected to the company's board of directors.

R. C. Wilson has been named manager, engineering, **T. D. MacLafferty,** manager, marketing, **Charles K. Skinner,** manager, manufacturing, and **R. J. Blair,** manager, finance, of the newly established Distribution Assemblies Department of the General Electric Co in Plainville, Conn.

Oliver Ramsaur, formerly assistant communications engineer, has been named communications engineer for Pennsylvania Power & Light Co. He succeeds **Charles S. Young,** who retired last month after more than 35 years with PP&L. Ramsaur came to PP&L in 1923, after service with Carolina Power & Light Co and Westinghouse Electric & Manufacturing Co.

Donald R. Guthrie has been named assistant general manufacturing manager of the coated abrasives and related products division of Minnesota Mining & Manufacturing Co. He was formerly executive engineer in charge of engineering research, having joined the company as a research chemist in 1939.

John N. Nassikas, deputy attorney general and counsel for the New Hampshire Public Utilities Commission, has resigned from that office to enter private law practice.

Theodore S. Fetter, Jr, has been appointed staff engineer in the Mechanical Engineering Division of Philadelphia Electric Co. Fetter, who was employed by the company in 1935 as a cadet engineer, was a senior engineer in the Mechanical Engineering Division until his recent promotion.

Westinghouse VP Gets Order of Merit

Robin S. Kersh, vice president and manager of Westinghouse Electric Corp's Northeastern Region was given the company's Order of Merit, highest company award for distinguished service, early last month. Kersh, who joined the company in 1929, received the award in the corporations New York offices from Tomlinson Fort, right, vice president in charge of the Westinghouse Apparatus Division. The recipient was once the company's manager of electric utility sales and manager of the Steam Division at Lester, Pa.

Here's why JENKINS GOLD SEAL TAPE goes further

GUARANTEED FOOTAGE — you get full measure in every roll.

NO WASTE — Gold Seal Friction Tape tears evenly, does not ravel, conforms closely to uneven surfaces. Selected base cloth is made to high strength specification.

HIGH DIELECTRIC STRENGTH — Less footage is needed per job with Gold Seal Tape. No pinholes . . . one thickness insulates.

LASTING "TACK" — adhesive compound is prepared under laboratory control; this means that Gold Seal will stick to the job under severe conditions of cold and moisture.

EASY HANDLING — Gold Seal does not peel, dry out or smear the hands in hottest weather.

CELLOPHANE-WRAPPED — Keeps Gold Seal Tape factory-fresh until you're ready to use it.

PACKAGED FOR CONVENIENCE — In single rolls or handy 10-roll containers, it's the best buy in tapes. Jenkins Bros., (Rubber Division), 100 Park Ave., New York 17, New York.

JENKINS

Gold Seal Tape

FRICTION . . . RUBBER

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

Carl Kadie, Jr, former manager of the United States Reclamation Bureau's Region II Delta District office, has accepted a position in the Reclamation Bureau's Chief of Engineers Office in Denver, Colo. Kadie is one of the engineers displaced when the Sacramento region was reorganized recently.

Marshall E. Fahlstrom, Gorge powerhouse superintendent for City Light at Seattle, Wash., has been promoted to the position of Skagit generation superintendent. He started with the utility as an operator's helper in 1931, became an inside constructor in 1935, and was promoted to generation superintendent at Diablo in 1941, moving to Gorge in 1952.

OBITUARY

Elmer F. Schmoll, 58, structural engineer for Pennsylvania Power & Light Co, died Oct. 20. He joined Pennsylvania P&L in 1920 and has supervised the engineering on all structures built for the utility for the last 30 years. He acted as structural consultant for all departments of the company.

George W. O'Keeffe, 53, assistant sales manager of the Allis-Chalmers Manufacturing Co's Boston Works, died Oct. 9. O'Keeffe, an electrical engineer, managed the motor control department at the Boston Works from 1931 to 1938. Affiliated with the National Electrical Manufacturers Association, he served from 1950 to 1951 as chairman of Nema's Power Circuit Breaker Group.

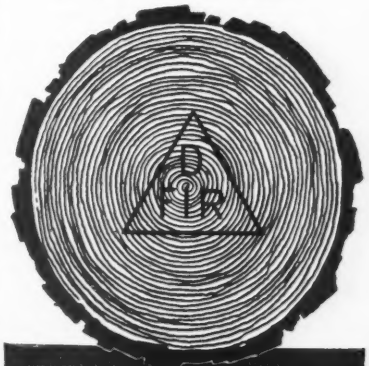
John Madison Labberton, 60, a pioneer in the development of air conditioning equipment, died at Bronx, N. Y. on Oct. 6. As an engineer with the Westinghouse Electric & Manufacturing Co from 1913 to 1935, he developed that company's first line of air conditioning equipment. At his death, he was professor of marine engineering at New York University.

Charles E. Young, 79, for many years engineer in charge of electric distribution and transmission for Pacific Gas & Electric Co, died Oct. 17. A graduate of Healds College in San Francisco, Young joined Pacific G&E in 1906 and retired in 1942.

FOR LONG LIFE and low service cost, the big 3 in western poles are Western Larch — Lodgepole Pine — Douglas Fir.

All 3 are grown on the virgin forest lands of the J. Neils Lumber Company in western Montana. All 3 are produced and treated in J. Neils modern pole plant at Libby, Montana.

J. Neils Lumber Company, since 1895 a quality manufacturer of forest products, invites your inquiry on transmission and telephone poles. An illustrated folder on J. Neils treated poles, and information regarding their application to your own requirements, will be furnished on request.



POLE DIVISION

J. Neils Lumber Company

Libby, Montana

Aluminum Units . . .

. . . are exempted from "Buy American" provision of Armed Services procurement regulations

The Defense Department has exempted all aluminum products from the "Buy American" provision of the Armed Services procurement regulations. Previously, only primary aluminum was exempt while semi-fabricated aluminum products were covered by the provision.

Under the "Buy American" provision, the government must buy defense materials from domestic suppliers exclusively, unless the materials are scarce or foreign prices are 25% below domestic prices.

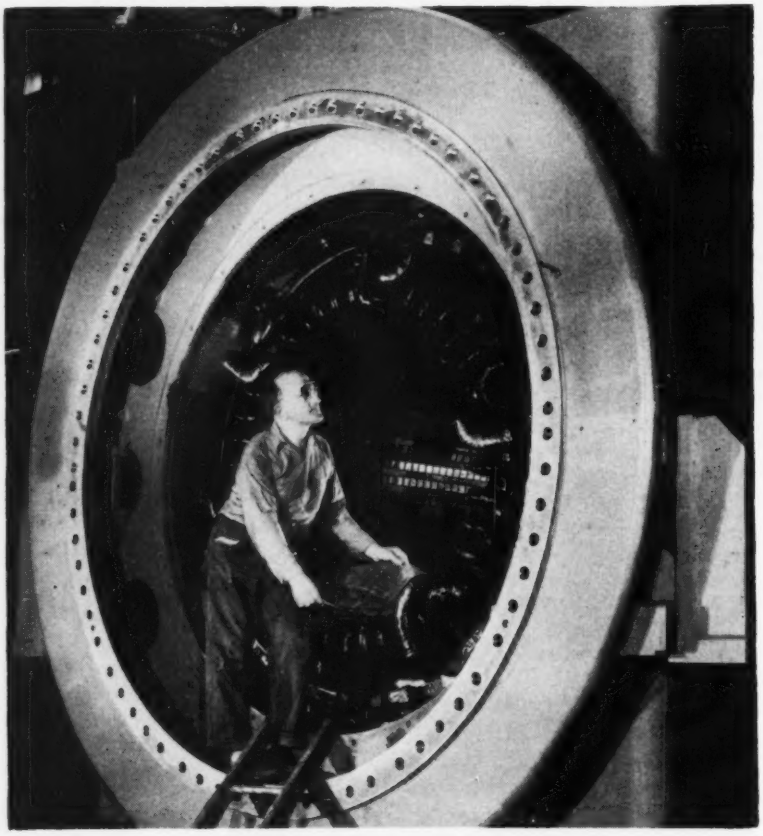
Purpose of the new Defense Department ruling is to make military aluminum purchasing consistent. The ruling was pushed through by the Association of Aluminum Warehouses, a group of U. S. distributors of imported semi-fabricated aluminum products.

The National Association of Aluminum Distributors, who distribute U. S.-made aluminum products like sheet, bar, and tubing, are no longer in short supply. In fact, they say, "The major problem confronting domestic aluminum producers is to employ their facilities at a percentage of capacity approaching financial and full employment levels." Therefore, they contend, semi-fabricated aluminum products should not be exempted from the "Buy American" provision.

GE Records Its Best Nine Months in History

General Electric Co's sales for the first nine months of 1953 totaled $2,341,048,000, the highest nine-months' level in the company's history. This marked an increase of 29% over the same period last year, according to Pres Ralph J. Cordiner.

Net earnings for the period also increased, rising to $116,386,000, equal to $4.03 per share of common stock. This represented an increase of 23% over the earnings for the corresponding period of 1952 of $94,-



More Power for Southwestern G&E

A workman in General Electric Co's turbine factory at Schenectady, N. Y., is here inspecting windings of a stator of a 44,000-kw steam turbine generator unit soon to be installed in the Lone Star Station of Southwestern Gas & Electric Co at Lone Star, Tex. The unit will operate with a steam pressure of 850 psi and temperature of 900°F.

MANUFACTURERS' EARNINGS

Company	Period Months	Ended	Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Babcock & Wilcox	9	Sept.	$7,728,000	$4,625,000	$5.21	$3.28
Buffalo Forge	3	Aug.	432,066	411,655	1.33	1.27
Colorado Fuel & Iron	3	Sept.	2,483,797	577,900	.94(a)	.25(a)
Continental Steel	3	Sept.	270,098	164,592	.54	.33
Continental Steel	9	Sept.	1,157,785	924,604	2.31	1.84
Continental Steel	12	Sept.	1,710,211	1,138,057	3.41	2.27
Copperweld Steel	9	Sept.	2,443,353	1,464,553	4.38	2.77
Johns-Manville	3	Sept.	4,493,586	6,205,416	1.42	1.95
Johns-Manville	9	Sept.	15,850,435	18,122,613	5.00	5.72
Minneapolis-Honeywell Regulator	3	Sept.	2,609,661	2,129,671	.87	.70
Minneapolis-Honeywell Regulator	9	Sept.	7,511,312	5,155,526	2.50	1.66
Owens-Corning Fiberglas	9	Sept.	4,276,051	4,055,398	1.36	1.29
Reynolds Metals	9	Sept.	15,704,253	9,304,914	8.70	5.12(b)
Smith, A. O.	12	July	(c)5,112,292	(c)5,023,530	5.11	5.02
Square D	9	Sept.	3,000,166	3,144,054	2.18	2.28
Texas	3	Sept.	47,372,566	46,521,437	1.72	1.69
Texas	9	Sept.	133,352,687	130,289,803	4.85	4.74
Union Carbide & Carbon	3	Sept.	26,419,015	24,299,162	.91(a)	.84(a)
Union Carbide & Carbon	9	Sept.	78,897,595	70,739,620	2.72(a)	2.45(a)
Worthington	9	Sept.	4,607,832	4,400,210	4.00(a)	4.00(a)
Youngstown Sheet & Tube	3	Sept.	8,057,691	2,546,846	2.41	.76
Youngstown Sheet & Tube	9	Sept.	23,001,897	11,051,464	6.87	3.30

Notes—(a) Based on shares outstanding at close of respective periods; (b) Based on shares now outstanding; (c) For 1953, includes $954,561 interest received on refund of federal taxes in connection with claims dating back to World War II period; for 1952, includes $1,050,030 tax adjustment credit.

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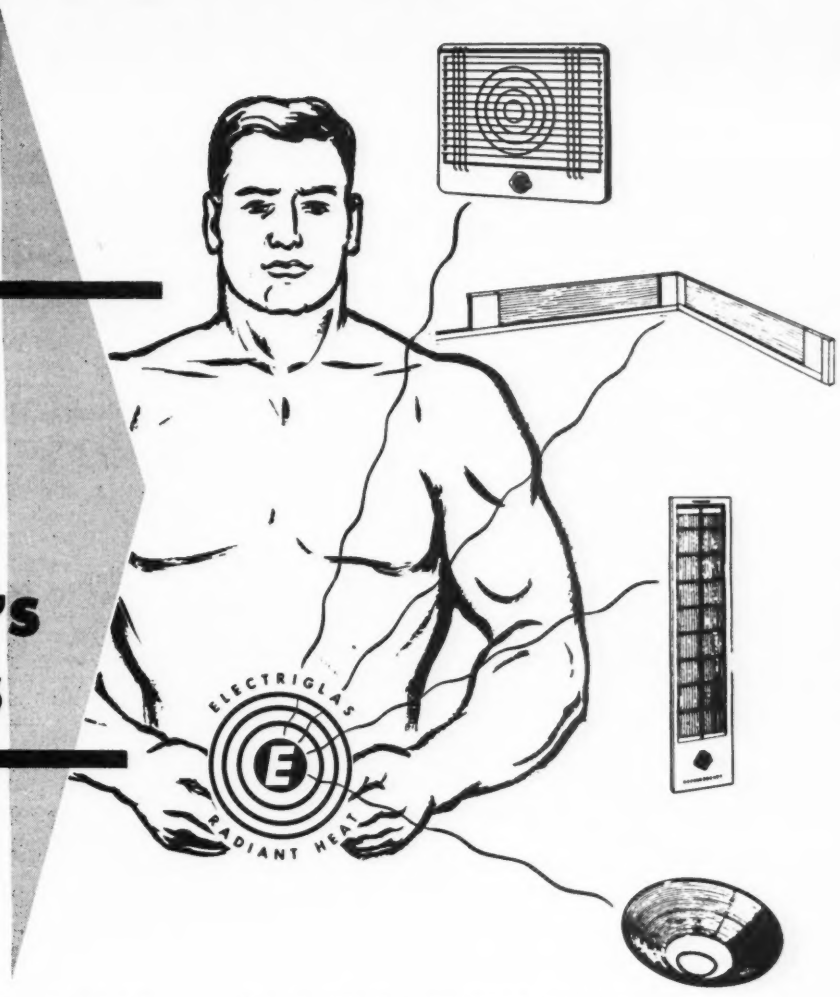

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ELECTRIGLAS PROVIDES maximum efficiency through utilization of radiant heating principles coupled with thermostatic control.

ELECTRIGLAS EFFICIENCY is proven by over ¼ million panels in operation in homes, factories, offices, stores, motels, public buildings . . . in such widely removed areas as northern Canada with below zero temperatures, and in the milder zones of the South.

ELECTRIGLAS OFFERS a means to level your load. And, for example, was responsible for the addition of over a million kilowatt hours in a small New Jersey area.

ELECTRIGLAS HAS a plan to spearhead acceptance. Brochures, pamphlets, cost guides, catalogues . . . keyed to meet the needs of both major and small utilities.

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OUR 104th YEAR

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$750,000, or $3.28 per share of common stock. The company's sales for the third quarter were $780,600,000, compared with $642,288,000 for the same period in 1952.

Commenting on the results so far this year, Pres Cordiner noted:

"We see nothing in this picture to justify the fears of a recession which are being expressed in so many quarters today." Adding that the principal source of concern has been an expected cutback in defense requirements, he said:

". . . the General Electric defense cutbacks will be gradual and are not expected to take effect until next year. In the meantime there is the opportunity to expand our efforts on normal peacetime activities."

Canadian Manufacturers Suffer Profits Decline

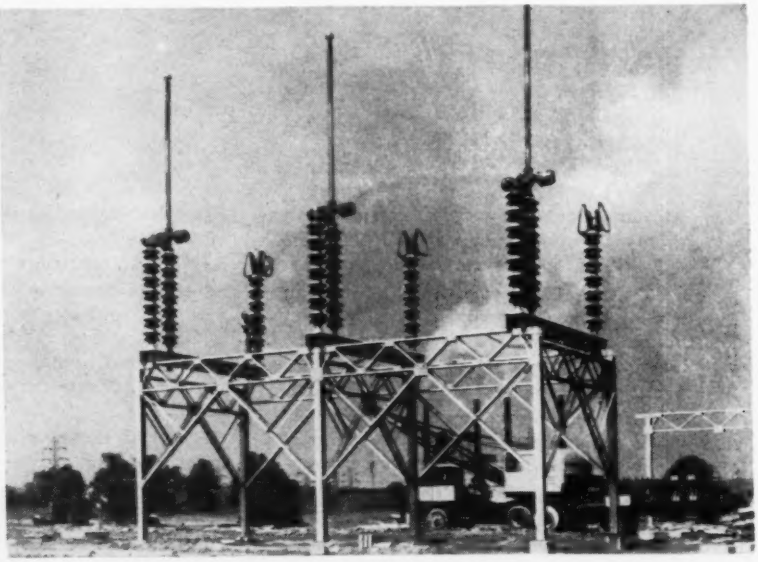
Canadian electrical manufacturing companies, the nation's fifth largest industrial group, realized an average profit of 4.1% during 1952, .8% lower than for the previous year, Brig F. C. Wallace, president of the Canadian Electrical Manufacturers Association, revealed recently.

Speaking before the association's annual press conference, he stated that a recent CEMA survey showed that only 1.2% of the average 1952 profit was paid in dividends to stockholders. The balance was re-invested to cover plant and equipment expansion, modernization, and replacement costs.

MANUFACTURING BRIEFS

Electro Engineering Works, Oakland, Calif., has purchased 2.3 acres in San Leandro, Calif., on which it will build a plant for manufacture of transformers. Detailed plans are being worked out.

Reliable Electric Co has added 22,000 sq ft to its Chicago plant. The building has been equipped with new



First 330-kv Switches Installed

First installations of 330-kv air switches in the U. S. are now being made at the Philip Sporn Plant and the Kanawha River Plant on the Appalachian Electric Power system, and the Muskingum River Plant of the Ohio Power Co. Both are American Gas & Electric Service Corp operating companies. The switches, designed by Delta Star Electric Division of the H. K. Porter Co, have the highest voltage rating of any yet installed in the country. They are vertical break type "MK-40", with a current rating of 1,600 amp. Each single pole switch weighs 5,400 lb, is 18 ft long, and, with the blade open, stands 26 ft 5 in. The blade is 13½ ft long and is counterbalanced.

receiving and handling facilities. Specially designed long-span steel construction with a minimum of vertical columns provides a maximum of uninterrupted floor space.

Hotpoint Co has formally opened a multi-million dollar refrigerator plant at Cicero, Ill. The plant, which has a production capacity of more than 400,000 refrigerators, was retooled following termination of a jet engine components contract for the Navy. Located near Hotpoint's range plant, the new factory covers 23 acres with approximately one million sq ft of manufacturing space. A full line of 1954 model refrigerators is now going into production at the plant, which will be staffed by about 15,000 employees.

MEETINGS CALENDAR

Edison Electric Institute
Electrical Equipment Committee, Jung Hotel, New Orleans, Nov. 2-3; Market Development and Electrical Applications Committee, Washington, Nov. 3-4; Accounting Executive Committee, Edgewater Beach Hotel, Chicago, Nov. 12-13; EEI-AGA General Accounting Committee, Jung Hotel, New Orleans, Nov. 30-Dec. 1.

Pennsylvania Electric Association
Fall Meeting, Systems Operation Committee, Castleton Hotel, New Castle, Pa., Nov. 5-6.

***American Institute of Electrical Engineers**
Fall General Meeting, Muehlebach Hotel, Kansas City, Mo., Nov. 2-6; Winter General Meeting, Hotel New Yorker and McAlpin Hotel, New York City, Jan. 18-22.

National Electrical Manufacturers Association
Annual Meeting, Haddon Hall, Atlantic City, N. J., Nov. 9-12.

Wisconsin Utilities Association
Electric and Gas Section Convention, Schroeder Hotel, Milwaukee, Nov. 11-13.

Institute of Radio Engineers
Annual meeting of Professional Group on Vehicular Communications, Somerset Hotel, Boston, Nov. 12-13.

Pacific Coast Electrical Association
Annual Hawaiian Conference, Honolulu, T. H., Nov. 19-20.

New Jersey Utilities Association
Annual meeting, Seaview Country Club, Absecon, N. J., Nov. 19-20.

Southeastern Electric Exchange
General Sales Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 19-21.

American Society of Mechanical Engineers
Annual Meeting, Statler Hotel, New York, Nov. 29-Dec. 4.

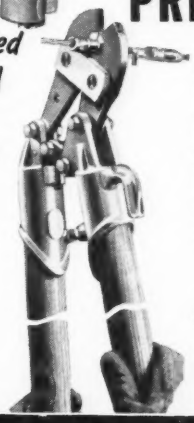
Interstate Power Club
Hotel Martinique, New York, Dec. 7.

Eastern Joint Computer Conference-Exhibition
Sponsored by Institute of Radio Engineers, Association for Computing Machinery, and American Institute of Electrical Engineers, Statler Hotel, Washington, D. C., Dec. 8-10.

Public Utilities Advertising Association
Region Two, Annual Meeting, Skytop, Pa., Dec. 10-11.

*Addition this week.

CLAMP-to-CLAMP CONTACT
AVOIDS CONDUCTOR PITTING with this
KEARNEY PRESSUR-TAP CLAMP



Easily Installed on Energized Lines with Pressur-Tap Installing Tools

The permanent, high-conductivity taps made with Pressur-Tap Clamps cannot possibly cause conductor pitting. Any arcing will occur between clamp halves. For this reason Pressur-Tap Clamps are especially recommended for installation beyond the armor rods. Clamps are made of aluminum and are plated for use with any type or combination of aluminum or copper conductors.

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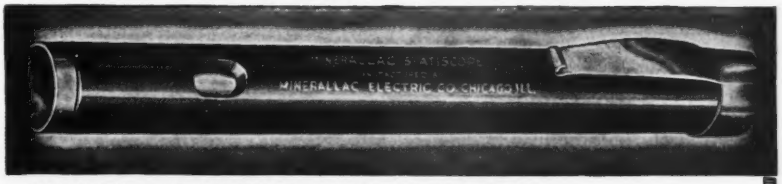

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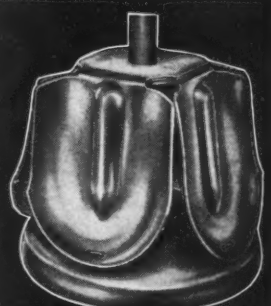

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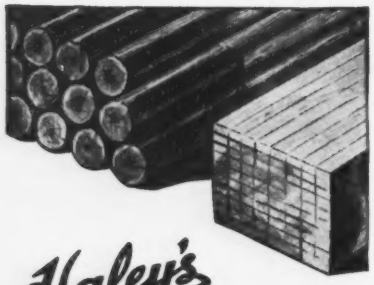

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with the patented
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Say "Goodbye to risky time-wasting fuss in testing with the 5 main safety features in the KNOPP Voltage Tester: (1) original Prod-mounting Socket in housing making this tester easier, faster, and safer to use and ending "three-handed" testing; (2) protection through Dual indication of voltage by solenoid and neon lamp working independently; (3) positive scale readings; (4) signal by hum and vibration; and (5) thorough insulation throughout, even to the sharp point of each prod.

Well-built and shockproof in a LAMINATED bakelite housing (not molded plastic), the KNOPP Voltage Tester tells immediately and simply if circuit is open or closed; magnitude of voltage between 110 and 600; a-c or d-c, pure or rectified; 25 or 60 cycles—for testing old and new circuits, fuses, locating grounds, etc.

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Electrical Facilities Inc.
4236 Holden Street Oakland 8, Calif.

Prime Movers Meeting

(*Continued from page* 79)

by increasing the hot air temperature.

3. Early difficulties were encountered with the forced draft fans. A slug of leaves clogged the strainers; shear pins were replaced but sheared again. Clogging was corrected by flushing the debris away by means of a sheet of high-velocity from a slotted pipe.

4. Twenty-foot sections of 15-in. I-beams broke away from the bunker bracing and jammed in the scale chutes.

Plant Visit . . . Following a visit to the plant by the 60 committee members and guests, a question period was held and the following facts brought out: (1) Coal costs less than $3 a ton (12¢ per million Btu) delivered on the pile. Moisture at times rises to 20%, volatile up to 36% and sulphur 1½ to 4%. (2) Precipitator has an 86% guarantee of efficiency for the first two units while a combination mechanical-electrical for the third is to be 97%. (3) Plant outlay for the three-unit completion was $36 million.

Lack of Research on Part of Utilities Cited at Parley

There is general lack of research development being carried on within the electric utility industry. This report was made by Dr J. E. Hobson, director of Stanford Research Institute, before the third annual fall conference of San Francisco section of American Society of Mechanical Engineers, Oct. 16. He added that most of the technological advancements in the industry have come from laboratories of larger electrical manufacturers.

Previewing results of a study of the industry made by the Palo Alto, Calif., research group for American Institute of Electrical Engineers, Hobson declared now is the time to look ahead at competition from future sources of energy. In addition, competition from government in the electric power business still must be considered and future plans made accordingly, he said.

Hobson attributed low level of utility research to two causes—lack of challenges within the industry for the superior engineering graduates, and

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STEEL & WIRE COMPANY
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salaries that are not competitive with other industries.

Observations by television of combustion zone in boilers is being used by Pacific Gas & Electric Co to bring about better burner efficiencies. This was stated by Eric A. Salo in reporting PG&E's experience of over a year with TV observations at Moss Landing Steam Station.

Salo reported that burner coking and plugging have been detected at an early stage. In addition, he said, TV observations make changeover from oil to gas firing, or vice versa, much easier and more efficient.

Experience with flue gas recirculation at Moss Landing has lived up to all expectations, stated Daniel A. Shiells, Bechtel Corp, and Warren D. Elston, Pacific G&E, in a joint paper. Gas recirculation allows temperature of initial and reheat steam to be held at design level of 1,000 F over 60% range of loading, they said. Excess air is used at Moss Landing after capacity of recirculating fan has been reached, the two men added.

Major problem at low loads has been burner stability, Elston said. Action of relatively cool recirculated gas sweeping across face of burners has caused loss of ignition on several burners. One solution is use of steel to deflect flue gas away from burner face, said Elston.

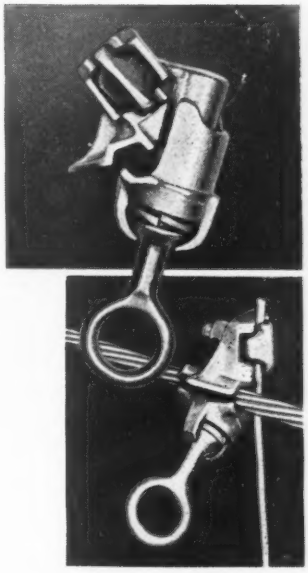
McKay Sees Difficulties in State Purchase of CVP

Stopping in Sacramento, Calif., after attending the National Reclamation Association convention in Reno, Nev., Secretary of the Interior Douglas McKay told newsmen he is not too "optimistic" about California's chances of taking over the Central Valley Project.

However, California's new governor, Goodwin J. Knight, emphasized at a news conference just a few minutes later the state is not giving up its thinking along that line.

McKay expressed the opinion it would be very difficult to put over the sale of the huge reclamation project to California. He reported, however, whenever the state wants to make a formal purchase offer "we'll be glad to sit down and discuss it." He pointed out a switch would not be possible without gaining the approval of Congress.

Dieck PT Hot Line Clamps Are Better because they are:



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• **STRONGER**—High strength materials and vise like design permits reuse of clamps.

• **VIBRATION RESISTANT** — Helical spring lockwasher bits in and prevents unscrewing.

• **STRESS CORROSION TESTED** — Passed mercurous nitrate test while under severe stress.

• **ANTI-SIEZE LUBRICATED**—Main operating threads are enclosed and protected by corrosion inhibiting lubricant.

Now made in two sizes for all types of connections. Data and prices on request.

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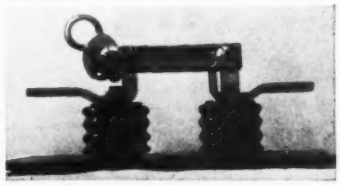

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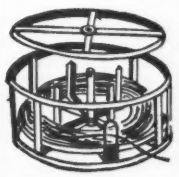

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Our quota can ONLY be met, if those who give *keep on* giving . . . regularly!

You CAN give more than once . . . as often as every three months with complete personal safety. The more often you give the more often you save a life. For every pint of blood you give goes to someone who needs it desperately.

Remember . . . once is NOT enough. Give blood again and again! Call your Red Cross, Armed Forces or Community Blood Donor Center for an appointment to give blood today.

GIVE BLOOD

...give it again and again

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CHECK THESE QUESTIONS

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ◯ HAVE YOU GIVEN YOUR EMPLOYEES TIME OFF TO MAKE BLOOD DONATIONS?
- ◯ HAS YOUR COMPANY GIVEN ANY RECOGNITION TO DONORS?
- ◯ DO YOU HAVE A BLOOD DONOR HONOR ROLL IN YOUR COMPANY?
- ◯ HAVE YOU ARRANGED TO HAVE A BLOOD-MOBILE MAKE REGULAR VISITS?
- ◯ HAS YOUR MANAGEMENT ENDORSED THE LOCAL BLOOD DONOR PROGRAM?
- ◯ HAVE YOU INFORMED EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ◯ WAS THIS INFORMATION GIVEN THROUGH PLAN BULLETIN OR HOUSE MAGAZINE?
- ◯ HAVE YOU CONDUCTED A DONOR PLEDGE CAMPAIGN IN YOUR COMPANY?
- ◯ HAVE YOU SET UP A LIST OF VOLUNTEERS SO THAT EFFICIENT PLANS CAN BE MADE FOR SCHEDULING DONORS?

Remember, as long as a **single** pint of blood may mean the difference between life and death for **any** American . . . the need for blood is **urgent!**

NATIONAL BLOOD PROGRAM

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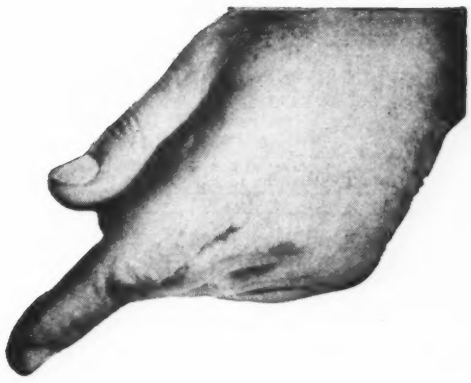

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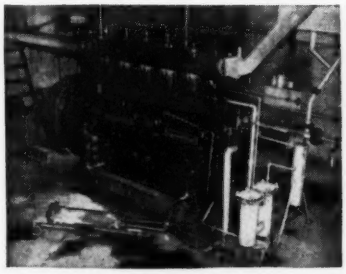

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2—	1750		G.E.	514	250 2400
1—	1500		C.W.	514	115 4000/13800
1—	1500		G.E.	720	600 13200
1—	1000		G.E.	900	260 4100/6900
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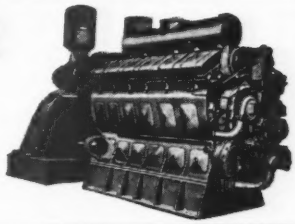

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750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Ingersoll-Rand	8-4	225	600
500	General Motors	8-278A	750	720	150	Buckeye	80	240	600
500	General Motors	8-567	720	720	100	Worthington	BB-5	150	600
480	Worthington	DD-8	700	360	100	General Motors	3-268A	150	1200
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600	•G. E.	TS	1.0	600
600	•G. E.	ATI	1.0	240
400	West.	HG	1.0	900
300	G. E.	ATI	.8	1200
300	G. E.	ATI	.8	900
300	•G. E.	ATI	1.0	720
300	Ideal	SNS	1.0	257
250	•Cr-Wh	25184	1.0	1800
220	•West.		1.0	600
190	El. Mhy.	2S	1.0	720
175	•West.	HR	1.0	360
150	•West.	HR	1.0	300
125	•G. E.	ATI	1.0	900
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Cole Electric Co.

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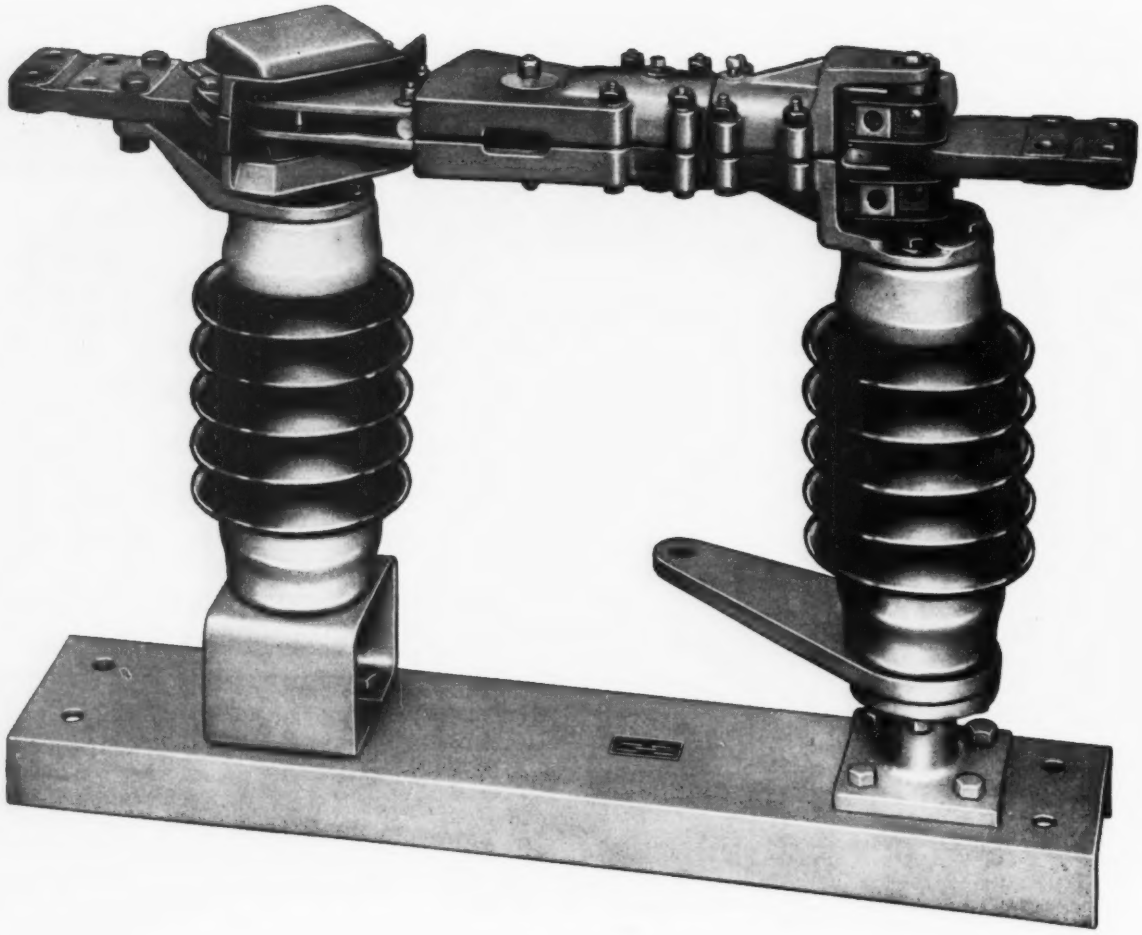
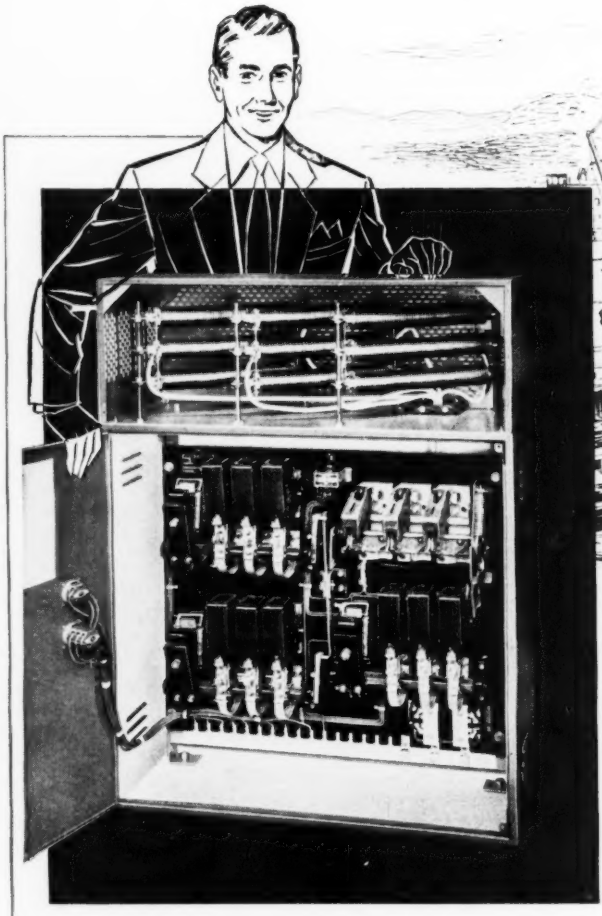


OUTDOOR DISCONNECTING SWITCH
15,000 Volts—1200 Amperes—Type LU
Side Break—Three Pole—Single Throw—Group Operated
SILVER TO SILVER CONTACTS
One Pole Shown
See Bulletin 42A

IT'S FEDERAL NOARK® MOTOR CONTROLS FOR THE PANAMA CANAL



ABOVE: View of the upper pair of the Miraflores locks and one of the control towers from which the new Federal Noark motor controls are operated.

AT LEFT: Interior view of one of the eight types of motor controls built for the canal project.

THE PANAMA CANAL is now undergoing an extensive modernization program. One phase requires new electric motor controls for the locks...and Federal Noark devices are being installed. These controls will assure the safe, efficient motor starting required for rapid and continuous canal service.

Special processes in the manufacture of these 398 motor controls were necessitated by the specifications. Wire insulation, for instance, and other parts likely to deteriorate under tropical conditions had to be protected against "attack by insects, especially cockroaches and termites," and made fungus-proof with suitable shellac. To accomplish this, Federal engineers treated each part separately before assembly.

Whether your control problems are simple or as complex as those for the Panama Canal, call in Federal Noark for the right solution.

Write Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

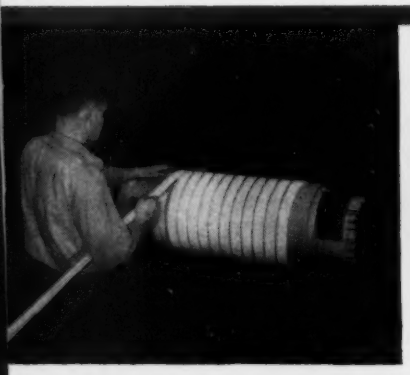
Plants at Newark, N. J.; Long Island City, N. Y.; Hartford, Conn.; Cleveland, Ohio; Gary, Ind.; St. Louis, Mo.; Dallas County, Texas; Los Angeles, Calif.; San Francisco, Calif.; Santa Clara, Calif. Affiliated plant, Toronto, Canada.

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric Manufacturing Corporation products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

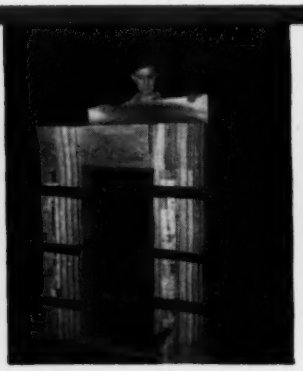
FEDERAL NOARK®

Federal NOARK

This is how *Kuhlman* craftsmanship assures you dependable transformers



1. The coils of Kuhlman power transformers are usually wound concentrically. Coils that are to carry heavy currents at low voltage are of the interleaved disc type. Above, a cylindrical LV core for a 1000 KVA transformer being wound with multiple wires transposed when necessary to maintain low stray losses.



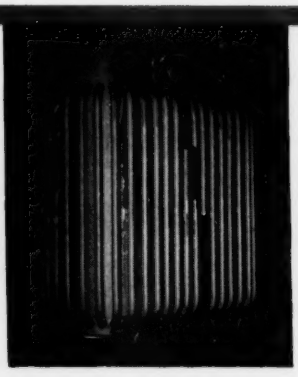
2. Assembling the core for a 1000 KVA transformer. After the assembler has finished inserting the laminations, the core will be inverted to receive the coils. The laminations are made of cold-rolled oriented silicon steel which permits the flux path to follow the grain of the steel producing high permeability and low hysteresis.

3. Here the core has been inverted and assembled to the lower part of the core clamp. The coils, which have been immersed in a thermo-setting varnish and baked, have been slipped over the legs of the core. The assembler is bracing the core to prevent shifting and vibration.

4. After the core has been braced, the assembler inserts the necessary laminations on top to complete the core. After this, the remainder of the core clamp will be assembled and the core and coil assembly will be ready to be lowered into the tank.

5. The tank is made of heavy steel plate, electrically welded at the seams. Here you see the cooling tubes being welded on the outside of a tank to provide oil-tight and rust-proof joints.

6. In this picture, the welded joints of the cooling tubes are being tested for leaks. After these tubes are put on the tank, the entire tank is filled with kerosene and subjected to air pressure as a final check to determine if the tank is completely oil-tight.



7. Finally, the entire tank is shot-blasted and painted with a coat of rust-inhibitive primer and two coats of corrosion resistant paint. The tanks are then ready to receive the core and coil assembly.

8. Kuhlman transformers are engineered for long life and dependability. They are built from carefully selected materials according to sound principles of design and assembled with infinite care and patience by skilled craftsmen with years of experience at their job. Then each transformer is thoroughly inspected and tested for safe, efficient performance. When you install your next transformer, specify Kuhlman for transformers of outstanding quality — backed by nearly 60 years of electrical manufacturing experience. Write us today for the name of your nearest Kuhlman representative.

Kuhlman ELECTRIC COMPANY, BAY CITY, MICHIGAN
CRYSTAL SPRINGS, MISSISSIPPI

KUHLMAN K E ELECTRIC

EXPORT REPRESENTATIVES: *International Standard Electric Corporation,*
50 Church Street, 15th Floor, New York 4, New York. Cable Address: Microphone, N. Y.